

Read : Application dt.20.07.2009 by M/s. ACE Calderys Ltd. holder of TIN 27120314259V.  
Heard : Shri Ashok Chandak, CA, alongwith Shri Sinha [General Manager, R & D] & Miss Patel, Tax Controller.

### PROCEEDINGS

(under section 56(1)(e) and section-56(2) of the MVAT Act, 2002)

No. DDQ 11/2009/Adm-3/38/ B-3

Mumbai, dt. 16/10/2014

The applicant M/s. ACE Calderys Ltd., situated at Nagpur Refractory Works, Plot No.A-1/1, MIDC, Butibori, Village - Ruikhairi, Nagpur-441 122, seeks to know the determination of the rate of tax of the products sold in the following invoices :

Sr. no.	Invoice No.	Date	Product
1	00786	07.06.14	WHYTHER A
2	00786	07.06.14	WHYTHER A (SUPREME)
3	00739	04.06.14	ACCMON 80 (special)
4	00707	31.05.14	ACCRAM MS-84
5	03187	26.12.13	ACCPLAST 55
6	00797	07.06.14	ACCPLAST 80 AL

#### 02. FACTS & CONTENTION

While informing that the applicant is manufacturing *inter-alia* "Refractories Monolithics", it is sought to know the rate of tax on 'Monolithics'. It is stated that the trade names of all the products are of company's own and are called Monolithics in the trade of Refractories Bricks. The following Table states the Trade Name and it's General Properties :

Product	Generic Properties
WHYTHER A. ACE SPEC.	High Purity Dense Castable
WHYTHER A. SUPRIM	High Purity Dense Castable
ACC MON 80 (SPL)	Low Cement Castable
ACC RAM M-84	Magnetic Ramming Mach.
ACC PLAST 55 ACE SPEC.	Plastics
ACC PLAST 80 AL	Plastic

The contents of the application are reproduced thus :

#### " A. STATEMENT OF FACTS

- The refractory bricks used to be manufactured as per the prescribed specifications supplied by the user customer. These were then used to be fixed on the inner lining of the furnace. But due to technological advent, this practice has become redundant due to its inherent inefficiencies and lesser life span. In recent times, the practice of prefabrication of refractory into brick and various other forms has been replaced by application of refractory monolithic (refractory castable) material (in powder form) by way of ramming mass, gunning material etc. by using mechanical devices. The application of this refractory monolithic on the furnace or the area by use of gun or other tools has become a practice in the industry. The same can be confirmed by way of technical submissions from various industries.
- The applicant submits that it has facility to manufacture the brick from refractories as well as the monolithic powder from refractory material of required specifications. Till the year 2000, the applicant used to receive the orders of pre-cast material of refractories, and the applicant used to



supply them to the customers. But the production of pre-cast refractories meaning thereby bricklike structures of refractories has been completely halted due to the fact that the customers shifted their usage from the pre-cast to refractory monolithic (refractory castable).

- The applicant is regularly filing its returns under Sales Tax Laws and is being assessed as per the law since the commencement of operations of the unit i.e. from F.Y. 1995-96. There was no dispute raised by the Sales Tax Department so far as the classification of goods manufactured by the applicant till the year 2004-05.
- The product 'Refractories Monolithics' manufacture by the applicant is an admixture of aggregates of different fractions and binders. The binder used in monolithic refractory formulations are either or combination of High Alumina Cement; clay; tar; pitch, resins; phosphate, silicate etc. As the name suggests 'Monolithic' a large mass with no or very few joints. Monolithic are supplied either as dry material packed in bags or pre-moistened mass which are used for construction of furnace working lining, installed by specialized hardware. For installation of materials, which are supplied in dry condition e.g. castable, gunning material, ramming masses, normally water is added prior to installation, to get a workable consistency. Whereas pre-moistened material like plastic Refractories are installed using suitable hardware, without any further addition of water or installation site.
- The applicant acquired the Refractory Division of M/s. ACE Ltd. w.e.f. 1.10.2005 and obtained Registration Certificate No.441122/V/011 (TIN No.27120314259V) under Maharashtra Value Added Tax Act, 2002 (the MVAT Act) w.e.f. 01.10.2005. As a result, the applicant filed returns for the period from 01.10.2005 to 31.03.2006 and also VAT Audit Report in Form-704 under R.C.No.441122/V/011 and TIN No.27120314259V for its business.
- As per the legal and technical position, the product 'Refractories Monolithics' is classified under Entry 3 of Schedule C appended to the MVAT Act after 01.05.2005 to till date. Entry C-3 after 01.05.2005 and as on today reads as under:-

3. All kind of bricks including Fly ash bricks and refractory bricks and Monolithics, aspalate roofing tiles, earthen roofing tiles"  
(Emphasis Supplies)

Thus, w.e.f. 1.5.2005, the word 'monolithics' is added to Entry-3 of Schedule 'C' appended to MVAT Act. Therefore, the applicant is of the opinion that the product 'Refractories Monolithics' sold in dry powder form is covered by Entry C-3 of Schedule appended to MVAT Act and attract tax @ 4%. Therefore, the applicant paid the tax @ 4% on the sales of product 'Refractories Monolithics' while filing the returns after 01.10.2005.

#### B. REASONS AND CIRCUMSTANCES IN WHICH DISPUTE HAS ARISEN

- W.e.f. 01.05.2005, there is a specific entry 3 in Schedule 'C' appended to the MVAT Act which included "Refractory Bricks and Monolithics" and the tax rate prescribed as per the said entry is @4%. Therefore, the applicant filed its returns under the MVAT Act by paying tax @4% on the sales of the said product.
- However, as per letter No.225 dtd.22.04.2009, the Deputy Commissioner of Sales Tax, Business Audit, Nagpur, directed the applicant that the product sold by the applicant is "Whytheat, ACCMON, ACCRAM, Ramming Mass etc." are covered by Excise Chapter heading 3816. Further stated in the said letter that the applicant tried to establish that the product sold are "Refractories Castable Monolithics" and as per Excise Tariff 'Monolithics is covered by heading 6903'. Therefore, viewed that the product sold by the applicant is not covered by Excise Tariff Heading "6903" and thus attract tax @12.5% as per Schedule 'E' appended to MVAT Act. Therefore, directed the applicant for payment of differential tax amount.
- In response to letter dtd.22.04.2009 issued by the Deputy Commissioner of Sales Tax, Business Audit, Nagpur the applicant filed its reply dtd.29.05.2009 explaining therein that the product sold are nothing but 'Refractory Monolithics'. It was specifically made it clear that when the specific entry in Schedule 'C' at Sr. No.3 is provided there is no necessity to apply the Excise Tariff heading to the produce to interpret the product and decide the applicable rate. Therefore, submitted to the Authority that the product sold by the applicant is nothing but "Refractories Monolithics" attracting tax @4% as per Entry C-3 of Schedule appended to MVAT Act.
- However, the Deputy Commissioner of Sales Tax, Business Audit, Nagpur has not agreed with the view of the applicant and insisted for payment of difference of tax between 4% and 2.5% on



the sales of product "Refractories Monolithics". Thus, the applicant sought legal advice from Senior Counsel who opined that product sold by the applicant is covered by Entry C-3 and attracts Tax @4% only. Since there was difference of opinion given by Business Audit and Legal Counsel it was thought that it is a fit case to have clear order in its own case to avoid further disputes. Therefore, the applicant is seeking this determination for product sold in the month of June 2009.

#### C. TECHNICAL LITERATURE AND THE APPLICANT'S CONTENTION AND OPINION

- In order to substantiate our claim that the product manufactured by us is refractory monolithics we submit as under:-
- That the applicant rely on its Annual Balance sheet for the year ended 31.03.2006. It can be seen from the Directors Report that the Nagpur Unit is manufacturing monolithics only.
- Copy of certificates from applicant's following stockiest certifying that product sold by them is technically calls 'Refractory Monolithics'.
  - (i) M/s. A.G.Alloys, Jalandhar.
  - (ii) M/s. Alltech Industries, Kanpur.
  - (iii) Indian Agencies Corporation, Delhi.
  - (iv) Graphite & Co., New Delhi.
- That as per the website of "Steellinks.com". it gives the list of various companies manufacturing refractories. Attention is invited to Page 2 where the name of Pilbrico Co., figures. This is words largest manufacture of "monolithics refractories". In the said website synonymous of "monolithics refractories" has been stated as under :-  
Pilbrico Co.  
 Monolithics refractories : plastics, ramming mixes, castables, gunning mixes, and precast shapes. Manufacturer of HyRATE gunning plastic and Plistix Injec-Tite pumpable refractory insulation. Complete turnkey construction services.
- Based on the above reference on the website of steellinks.com, the applicant further visited the website of Pilbrico Co. Pg. 1 i.e. home page of the said company. The applicant form opinion that Pilbrico Co., has been an innovative leader in monolithics refractories products and application since 1914. Thereafter, also visited the data sheets for the various products which are called as a Monolithics Refractories Products. On comparison of products of the Pilbrico Co. with the products manufactured by the applicant it will notice that the applicant is also manufacturing the same product. In case of Pilbrico the percentage of  $Al_2O_3$  goes on changing based on the customer to customer so is also in the case of the applicant. The above proves that the applicant is manufacturing "monolithics" i.e. refractories product.
- Copy of Chapter 2 (Part 1) and Copy of Chapter 2 (Part 2) from a book 'Technology of Monolithics Refractories' published originally in 1979 by Pilbrico Japan Co. Ltd., in Japanese language and thereafter in January 1984 they made English translation of the said book. The Chapter 2 (Part 1) of the book referred above describe the characteristics (history and overview). According to the said chapter "Monolithics Refractories" are variously referred to as follows:-
 

Unshaped refractories	Mouldable refractories
Specialties	Pliable refractories
Specialty refractories	Refractory concrete
Jointless firebrick	Castable refractories
- This clearly shows that castable refractories, mouldable refractories, unshape refractories are nothing but a monolithics. On Pg. 12 and 13 of the said book comparison of firebricks and monolithic refractories has been given.
- In Chapter 1 of Part 2 of the book referred above "monolithic refractories and their types" are described.
- Table 2.1 of the chapter gives the variety and features of the principal monolithic refractories. Therefore the product manufactured is covered in first 8 items of the table.
- The section 1 of Chapter 1(Part 4) of the said book given "classification based on physical state". Table 2.2 state that the appearance of monolithic refractories could be in powder state, mud state and paste state.
- A paragraph below the table 2.2 reads as under :-  
 "A monolithic refractories may contain moisture when it is supplied or may be mixed with water



when used at site. The castable refractories in table 2.2 contain cement and will harden if mixed in advance with water. Water therefore, is mixed with the castable just before use. As a result, this variety is supplied as a powder".

- The above para of the books further makes it very clear as to why under Central Excise Tariff Heading 3816 the monolithic refractory in powder form is covered. The Tariff Heading 3816 deals with the refractories cement. As mentioned in the above reference the 'powder state monolithic refractories' contain the cement and therefore it is being cleared under Chapter Heading 3816.
- No doubt monolithic refractories is an industrial input. However, there is no need to include this in the notification issued under Entry C-54. The purpose of notification under Entry C-54 is to specify the industrial inputs which are not covered in any entry of schedule 'C' and tax them @4%. However, 'Monolithic Refractories' being specifically covered under Entry C-3 of Schedule appended to MVAT Act, it is not necessary to clarify the product as industrial input. It may further be pointed out that when MVAT Act was enacted w.e.f.01.04.2005 the words monolithics were not covered in Entry C-3. The same are added w.e.f.01.05.2005. This addition is to clarify that monolithics are nothing but Refractories.
- It may be mentioned here that the reference to Central Excise Tariff Entries is made only in the various notifications issued under various entries. For example- notification relating to industrial inputs under Entry C-54. In those cases only the product listed in notification will have to be interpreted with reference to Central Excise Tariff Entries. In all other cases the schedule entries where there is no reference of Central Excise Tariff Heading, the interpretation of the Central Excise Tariff Heading cannot be brought into. It is again a settled legal position that any other legislation can be read into a Sales tax Law only if the reference of that legislation is made under the Sales Tax Laws and the same can be read only for that limited purpose. Therefore, while interpreting the entries in various notifications where the reference of Central Excise Tariff Heading is given, one will have to make a reference of Central Excise Tariff but where the reference of Central Excise heading is not made under schedule entries, Central Excise Schedule cannot be read in the entry.
- It is already clarified earlier that why the refractory monolithics containing the cement, are covered under Central Excise Tariff Heading under Chapter Heading 3816 and since the entry C-3 deals with refractory monolithics without further making any classification as to whether containing a cement or not containing a cement, the product even if same it is clear that under Chapter Heading 3816 still will have to be called as a refractory monolithics for the purpose of Sales Tax Law.
- Going by above rules, the entry which has been amended w.e.f.01.05.2005, talks about the 'refractory bricks and monolithics'. It may be possible that the 'refractory bricks' may have been covered under one heading under the Excise Schedule and 'monolithics' may have been covered under separate heading under Excise Schedule. However, so long under the Sales Tax Law, the same is considered under a one single entry and it has to be read as a part of the said entry.
- In the above submission, we have submitted authentic document in the form of a book published by an Internationally Acclaimed Largest Monolithics Manufacturer. Similarly, the product list of the said company which is directly comparable with the product manufactured by the applicant. Thus in a common commercial parlance also the product is called as 'Refractory Monolithics' and therefore, the same will have to be covered under entry C-3.
- It is further submitted that the dictionary meaning of the word 'monolithics' as per Collins English Dictionary, is as under:-  
"Monolithic : relating to, or like a monolith 2. characterized by hugeness, impenetrability, or intractability: a monolithic government. 3. Electronics. (of an integrated circuit) having all components manufactured into or on top of a single chip of silicon. Compare hybrid (sense 6)".
- This meaning read with the entry makes it clear that anything relating to unshaped refractories is monolithic.
- It is also submitted that word 'monolithics' is a technical term. It is again a settled principle of law for interpretation of schedule entry under Sales Tax Law that, whenever technical word is used in the entry, technical or dictionary meaning attached to it will have to be considered.
- The technical literature referred earlier as well as dictionary meaning given above, makes it clear that the product manufactured is nothing but a monolithic.



- We have also submitted the dictionary meaning of the word 'monolithics'. In dictionary the word 'monolithics' means "relating to" or 'like a monolith'. No doubt dictionary meaning of the word "monolith" is having a definite shape. However word monolith and monolithics are not synonymous to each other. If that would have been case then in dictionary word 'like' would not added. Further the first meaning of the word is 'relating to'. When the word 'relating to' is read in Entry 3 of Schedule 'C' it makes it clear that the entry will have to read as under. "Refractory bricks and related to". The 'related to' could be 'of any size or shape' or could be 'without any size or shape'.
- The Supreme Court case in Delhi Cloth and General Mills Co. Vs. State of Rajasthan (46 STC 256) has held that "words and expressions describing an article or commodity, the turnover of which is taxed in a sales tax enactment must be construed in the sense in which they are understood in the Trade by the dealer and the consumer". We have already submitted Certificates from 4 of our purchasers establishes that the product sold by us, in a commercial parlance, is understood as monolithics.
- In our earlier submissions as well as above we have given dictionary meaning of the term 'monolithics'. We may further add that the Supreme Court of India in case of State of Orissa Vs. Titaghur Paper Mills Co. and Mangalji Mulji Khara (60 STC 213) has held that "court may take aid of dictionaries to ascertain meaning of the word in absence of the statutory definition or judicial interpretation".
- It is our submission that, the word monolithic is not at all defined under the MVAT Act. So also judicial interpretation of the word is not available. In that view of the matter following the above referred decision of the Supreme Court to interpret the word 'monolithics' one may have to refer international technical meaning of the term 'monolithics'. So also the dictionary meaning.
- It is further submitted that in our earlier submission we had stated that for interpreting the entry, the rule of Ejusdem generis is required to be followed. This rule is applicable when particular words pertaining to a class, category or genus are followed by general word. The entry C-3 has used the word 'refractory bricks and monolithic'. Applying the rule, since most of shaped refractory material comes either in a rectangular or square form it will be called as a refractory bricks. The word and 'monolithics' is thereafter is a generic word in the field of refractories 'all other unshaped materials' are monolithics. For this rule of interpretation we would like to rely on a decision of Supreme Court in case of Grasim Industries Ltd. v. Collector of Custom (128 STC 349).
- We may further submit that the Supreme Court in the case of Real Optical Co. Vs. Appellate Collector of Customs (122 STC 555) has held that "identity of an article is associated with its primary function". The primary function of the product which we are supplying is to act as a refractory lining material.

#### D. GROUNDS FOR DETERMINATION

- For that on facts and circumstances of the case, it may held that product sold by the applicant under various name vide invoices under reference are covered by words 'Refractory Bricks and Monolithics' in Entry 3 of Schedule 'C' appended to MVAT Act and therefore liable to tax @ 4% under MVAT Act.

### 03. HEARING

Sh. Ashok Chandak, CA, alongwith Sh. Sinha [General Manager, R & D] & Ms.

Patel, Tax Controller attended the hearing and submitted thus :

1. The product is covered by entry C-3.
2. The word 'monolithics' is understood to be unshaped refractories.
3. A compilation No.1 is submitted which contains copies of certain document.
4. Clauses C-8 & C-15 of the original application were sought to be amended.
5. About 6 bills are submitted for determination and the products are named differently in each bill such as Whytheat A, ACCMON, ACCRAM, ACC PLAST, it was queried as to whether they are the same product. To this, it was submitted that all the products are unshaped refractories/castables. The products are referred to differently when the composition of the



- ingredients changes.
6. The arguments as made in the application were reiterated.
  7. The applicant has placed reliance on the book – Monolithic Refractories by Sh. Subrata Banerjee to invite attention to the meaning of the word 'Monolithics' as mentioned therein.
  8. With regard to the contention about unshaped refractories, it was queried as to whether 'concrete' could be termed as 'monolithics'. To this it was replied that, concrete is a generally understood term and cannot be confused with the term 'monolithics' –technically, it may be but not by general parlance. Besides, the refractory castables is not a cement as held by the Hon. Supreme Court in ACC vs. State of Madhya Pradesh (144 STC 95).
  9. The applicant requests for prospective effect if the decision is not as per his contention for the following reasons:-
    - a. Business Audit conducted in the year 2008 has caused the applicant to apply for DDQ.
    - b. The period of business audit was 2007-08 and the issued has not been decided yet. Hence, they were under bonafide belief.
    - c. DDQ application is of 2009 which is not yet decided.

#### 04. OBSERVATIONS

I have gone through the facts of the case. The applicant informs that the products placed for determination are known as 'refractory monolithics'. It is stated that they are unshaped refractories/castables. The entry under which claim is being laid is entry 3 of Schedule 'C' appended to the Maharashtra Value Added Tax Act,2002 (MVAT Act,2002) which reads thus –

All kinds of bricks including fly ash bricks and refractory bricks, asphaltic roofing tiles, earthen roofing tiles.	4%	1.4.2005 to 30.4.2005
All kinds of bricks including fly ash bricks and refractory bricks and monolithics, asphaltic roofing tiles, earthen roofing tiles.	4%	1.5.2005 to 31.03.2010
- Do -	5%	01.04.2010 to date

It is contended that the impugned products are covered by the word 'monolithics' as appearing in the above entry. It can be seen that the word 'and monolithics' have been added w.e.f 01.05.2005. The State of Maharashtra introduced the Value Added Tax based system w.e.f 01.04.2005. To implement the new tax system with uniformity across all the States and Union Territories of the Republic of India, an apex body, the Empowered Committee of the State Finance Ministers was set up. It was on the recommendations of this Committee, as reflected in the minutes dt.27.04.2005, that the product 'Refractory monolithic' was sought to be introduced under the 4% tax slab in the State. Since the existing entry already covered 'refractory bricks', the effect to the recommendations was given by the addition of the words 'and monolithics' in the existing entry.

Now, a perusal of the entry reveals that the entry is for 'bricks', a product having a certain shape or dimension. The other products of the entry, too, occur in definite shape or size for e.g. fly ash bricks and refractory bricks, asphaltic roofing tiles, earthen roofing tiles. I have had to refer to this peculiar aspect of the entry as I find that the products placed for determination are unshaped materials in the form of powder, granules or paste. However, to make any comments in respect thereto, it becomes imperative for me to ascertain what



the words 'Refractory monolithics' connote. Hence, I would refer to the available data as regards the same thus -

#### **REFRACTORY - MEANING**

*Noun – a substance that is resistant to heat.*

*Adjective - Difficult to melt or work; resistant to heat: a refractory material such as silica.*

*Noun—a material that retains its shape and composition even when heated to extreme temperatures.*

*Noun – refractories, bricks of various shapes used in lining furnaces.*

*Noun—refractory-lining consisting of material with a high melting point; used to line the inside walls of a furnace*

#### **REFRACTORY - ENCYCLOPAEDIA BRITANNICA – INTERNET**

any material that has an unusually high melting point and that maintains its structural properties at very high temperatures. Composed principally of ceramics, refractories are employed in great quantities in the metallurgical, glassmaking, and ceramics industries, where they are formed into a variety of shapes to line the interiors of furnaces, kilns, and other devices that process materials at high temperatures.

The word refractory comes from the French *réfractaire*, meaning "high-melting."

Clay-based refractories

In this section the composition and properties of the clay-based refractories are described. Most are produced as preformed brick. Much of the remaining products are so-called monolithics, materials that can be formed and solidified on-site. This category includes mortars for cementing bricks and mixes for ramming or gunning (spraying from a pressure gun) into place. In addition, lightweight refractory insulation can be made in the form of fibreboards, blankets, and vacuum-cast shapes.

#### **REFRACTORY - MERRIAM-WEBSTER**

Material that is not deformed or damaged by high temperatures, used to make CRUCIBLES, incinerators, insulation, and furnaces, particularly metallurgical furnaces. Refractories are produced in several forms: molded bricks of various shapes, bulk granular materials, plastic mixtures consisting of moistened aggregates that are rammed into place, castables composed of dry aggregates and a binder that can be mixed with water and poured like concrete, and mortars and cements for laying brickwork.

#### **REFRACTORY - THE REFRACTORIES INSTITUTE**

*What Are Refractories?*

Refractories are heat-resistant materials that constitute the linings for high-temperature furnaces and reactors and other processing units. In addition to being resistant to thermal stress and other physical phenomena induced by heat, refractories must also withstand physical wear and corrosion by chemical agents. Refractories are more heat resistant than metals and are required for heating applications above 1000°F (538°C).

While this definition correctly identifies the fundamental characteristics of refractories--their ability to provide containment of substances at high temperature--refractories comprise a broad class of materials having the above characteristics to varying degrees, for varying periods of time, and under varying conditions of use. There are a wide variety of refractory compositions fabricated in a vast variety of shapes and forms which have been adapted to a broad range of applications. The common denominator is that when used they will be subjected to temperatures above 1000°F (538°C) when in service. Refractory products fall into two categories: brick or fired shapes, and specialties or monolithic refractories. Refractory linings are made from these brick and shapes, or from specialties such as plastics, castables, gunning mixes or ramming mixes, or from a combination of both.

Many refractory products, in final shape, resemble a typical construction brick. However, there are many different shapes and forms. Some refractory parts are small and may possess a complex and delicate geometry; others are massive and may weigh several tons in the form of precast or fusion cast blocks.

*What Are Refractories Made Of?*

Refractories are produced from natural and synthetic materials, usually nonmetallic, or combinations of compounds and minerals such as alumina, fireclays, bauxite, chromite, dolomite, magnesite, silicon carbide, zirconia, and others.

*What Are Refractories Used For?*

In general, refractories are used to build structures subjected to high temperatures, ranging from the simple to sophisticated, e.g. fireplace brick linings to reentry heat shields for the space shuttle. In industry, they are used to line boilers and furnaces of all types--reactors, ladles, stills, kilns--and so forth.

Depending upon the application, refractories must resist chemical attack, withstand molten metal and slag erosion, thermal shock, physical impact, catalytic heat and similar adverse conditions. Since the various ingredients of refractories impart a variety of performance characteristics and properties, many refractories have been developed for specific purposes.

#### **REFRACTORY - WIKIPEDIA**

A refractory material is one that retains its strength at high temperatures. ASTM C71 defines refractories as "non-metallic materials having those chemical and physical properties that make them applicable for structures, or as components of systems, that are exposed to environments above 1,000 °F (811 K; 538 °C)".

Refractories can be classified on the basis of chemical composition, method of manufacture, physical form or according to their applications, fusion temperature.

*Based on chemical composition[edit]*

*Acidic refractories[edit]*

They consist of mostly acidic materials like alumina ( $Al_2O_3$ ) and silica ( $SiO_2$ ). They are not attacked or affected by acidic materials, but easily affected by basic materials. They include substances such as silica, alumina, and fire clay brick refractories.



### Neutral refractories[edit]

These are used in areas where slags and atmosphere are either acidic or basic and are chemically stable to both acids and bases. The main raw materials belong to, but are not confined to, the  $R_2O_3$  group. The common examples of these materials are alumina ( $Al_2O_3$ ), chromia ( $Cr_2O_3$ ) and carbon.

### Basic refractories[edit]

These are used on areas where slags and atmosphere are basic; they are stable to alkaline materials but could react with acids. The main raw materials belong to the RO group to which magnesia ( $MgO$ ) is a very common example. Other examples include dolomite and chrome-magnesia. For the first half of the twentieth century, the steel making process used artificial periclase (roasted magnesite) as a lining material for the furnace.

### Based on method of manufacture[edit]

1. Dry press process
2. Fused cast
3. Hand molded
4. Formed (normal, fired or chemically bonded)
5. Un-formed (monolithic-plastic, ramming and gunning mass, castables, mortars, dry vibrating cements.)
6. Un-formed Dry refractories.

### Shaped[edit]

These have standard size and shapes. These may be further divided into standard shapes and special shapes. Standard shapes have dimension that are conformed by most refractory manufacturers and are generally applicable to kilns or furnaces of the same types. Standard shapes are usually firebrick that have a standard dimension of  $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$  inches and this dimension is called a "one brick equivalent". "Brick equivalents" are used in estimating how many firebrick it takes to make an installation into an industrial furnace. Special shapes are specifically made for particular kilns or furnaces. Precast refractory shape technology has become a specialized field within the refractory industry in recent years. As demands increase for greater refractory lining performance and lower maintenance costs, refractory users are finding that one effective way to achieve those goals is to incorporate a broader use of precast refractory shapes into their lining systems.

### Unshaped (Monolithic refractories)[edit]

These are without definite form and are only given shape upon application. These types are better known as monolithic refractories. The common examples are plastic masses, Ramming masses, castables, gunning masses, fettling mix, mortars etc.

Dry vibration linings often used in Induction furnace linings are also monolithic, and sold and transported as a dry powder, usually with a magnesia/alumina composition with additions of other chemicals for altering specific properties. They are also finding more applications in blast furnace linings, although this use is still rare.

## LECTURE 9 - REFRACTORY MATERIALS - NATIONAL PROGRAMME ON TECHNOLOGY ENHANCED LEARNING

### Types of refractory materials

This can be discussed in several ways, for example chemical composition of refractory or use of refractory or method of manufacture or in terms of physical shape. Below is given type of refractory depending on its chemical composition and physical shape.

#### A) Chemical composition

Refractories are composed of either single or multi-component in organic compounds with non metallic elements.

##### Acid refractory

The main raw materials used are  $SiO_2$ ,  $ZrO_2$  and aluminosilicate. They are used where slag and atmosphere are acidic. They cannot be used under basic conditions. Typical refractories are fireclay, quartz and silica.

##### Basic refractory

Raw materials used are  $CaO$ ,  $MgO$ , dolomite and chrome-magnesite. Basic refractories are produced from a composition of dead burnt magnesite, dolomite, chrome ore.

##### Neutral refractory

Neutral refractory is chemically stable to both acids and bases. They are manufactured from  $Al_2O_3$ ,  $Cr_2O_3$  and carbon.

#### B) Physical form

Broadly speaking refractory materials are either bricks or monolithic.

Shaped refractories are in the form the bricks of some standard dimensions. These refractories are machine pressed and have uniform properties. Special shapes with required dimensions are hand molded and are used for particular kilns and furnaces. Different types are:

- i. **Ramming refractory material** is in loose dry form with graded particle size. They are mixed with water for use. Wet ramming masses are used immediately on opening.
- ii. **Castables refractory materials** contain binder such as aluminate cement which imparts hydraulic setting properties when mixed with water. These materials are installed by casting and are also known as refractory concretes.
- iii. **Mortars** are finely ground refractory materials, which become plastic when mixed with water. These are used to fill the gap created by a deformed shell, and to make wall gas tight to prevent slag penetration. Bricks are joined with mortars to provide a structure.
- iv. **Plastic refractories** are packed in moisture proof packing and pickings are opened at the time of use. Plastic refractories have high resistance to corrosion.

### Monolithic refractories

Monolithic refractories are replacing conventional brick refractories in steelmaking and other metal extraction industries. Monolithic refractories are loose materials which can be used to form joint free lining. The main advantages of monolithic linings are

- Greater volume stability
- Better spalling tendency
- Elimination of joint compared with brick lining



- Can be installed in hot standby mode
- Transportation is easier

Monolithic refractories can be installed by casting, spraying etc.

Ramming masses are used mostly in cold condition so that desired shapes can be obtained with accuracy.

**WEBSITE OF COMPETENCE NETWORK FOR SMALL AND MICRO LEARNING ENTERPRISES – BOOK ON GLASS MELTING POT FURNACE : MANUAL FOR CONSTRUCTION, OPERATION AND TROUBLESHOOTING AND CHAPTER 12 - INTRODUCTION TO REFRACTORIES**

Refractories are materials having high melting points, with properties that make them suitable to act as heat-resisting barriers between high and low temperature zones.

**12.0 Background**

Refractory materials are generally tailor-made on the basis of:

- Process parameters like temperature profile, mode of operation, chemical environment, etc.
- Expected quality characteristics
- Best techniques for engineering and application, so that the final physical, chemical, mechanical, and thermal properties are compatible to the application

Refractory materials are used in two different forms, namely, shaped and unshaped products.

**12.1 Shaped refractories**

The most familiar form of refractory materials is the rectangular brick shape. However, refractories are presently available in a variety of shapes and sizes for convenience in construction.

**12.2 Unshaped refractories**

There is a class of refractory materials which can form joint-less lining. This class of refractory materials is called monolithic. All unshaped refractory materials have this ability to form joint-less lining, and hence they are grouped as monolithic.

- Unshaped refractories are manufactured in powder form as granular material and known as castables, ramming masses, gunning mix, plastic masses, etc.
- Castables are mixed with water before casting.
- Ramming masses are first mixed with water or any other liquid to the required quality, and then rammed either manually or pneumatically with a heavy rammer.
- Gunning masses are passed through a machine in which the powder material is put under pressure and conveyed pneumatically through a hose. The material gets mixed up with water before it exits the hose nozzle, and sticks to the surface on which it is applied to form a lining.

Plastic masses comprise ready-mix material that is applied manually in the furnace to form a lining.

**PDH COURSE M158-OVERVIEW OF REFRACTORY MATERIALS-A.BHATIA, B.E.-2012**

Classification Based on Method of Manufacture

The refractories can be manufactured in either of the following methods:

- Dry Press Process
- Fused Cast
- Hand Molded
- Formed (Normal, Fired or chemical bonded)
- Unformed (Monolithic – Plastics, Ramming mass, Gunning, Cast able, Spraying

Classification Based on Physical Form

Refractories are classified according to their physical form. These are the shaped and unshaped refractories. The former is commonly known as refractory bricks and the latter as “monolithic” refractories.

**Shaped Refractories:**

Shaped refractories are those which have fixed shaped when delivered to the user. These are what we call bricks.

Brick shapes maybe divided into two: standard shapes and special shapes. Standards shapes have dimension that are conformed to by most refractory manufacturers and are generally applicable to kilns and furnaces of the same type.

Special shapes are specifically made for particular kilns and furnaces. This may not be applicable to another furnaces or kiln of the same type.

SHAPED	UNSHAPED
1. Alumino Silicates • High Alumina • Low Alumina 2. Silica 3. Basic • Magnesite • Mag-Chrome • Mag-Carbon • Forsterite • Dolomite 4. Carbon 5. Zirconia • Zircon (Acidic) • Zirconia (Neutral) 6. Carbides/Nitrides • Silicon Carbide • Silicon Nitride • Boron Carbide • Boron Nitride 7. Pure Oxides • Ferrites • Hafnium Oxides	1. Mortars 2. Castables • LCC • ULCC • NCC • SFC 3. Gunning Mass 4. Ramming Mass 5. Filling Mass 6. Fetting Mass 7. Spraying Compound 8. Patching/Coating Mass



**PROJECT PROFILE ON MONOLITHIC REFRACTORIES - PREPARED BY : BR. MSME-DI, DURGAPUR, WBSIDC INDUSTRIAL ESTATE J. P. AVENUE, DURGAPUR (W.B.) – 713212**

**1. INTRODUCTION :** Refractory Industry is an important field which caters the need of various consuming industries including core industries like Iron & Steel, Glass, Cement, Ceramic, Fertilizer, Petrochemicals, Power generation, Non-ferrous etc. In case of industries with high temperature activities, Refractories are essential. In Indian Standard, IS: 4041-1987, the word "Monolithic" is defined as „Glossary of terms relating to Refractory Materials" as 'Jointless', for example as applied to linings that are rammed or cast in situ". In the industry, the term Monolithic Refractories or Mololithics or simply Monoliths are applied to a group of refractory-cements, castables, ramming and gunning mixes that may be cast, poured, rammed, gunned or vibrated in place to form an integral furnace linings as opposed to being built of jointed brick work.

**PRODUCTIVITY PORTAL INDIA - NATIONAL PRODUCTIVITY COUNCIL**

The structure of the furnace consists mainly of refractory bricks and cement, which must be able to withstand the high furnace temperatures and must be carefully selected and constructed. The furnace structure may contain monolithic refractories, which can be shaped in situ, e.g. those used for burner quarls. There are three basic types of monolithic refractories

- ✓ Castables;
- ✓ Mouldables;
- ✓ Ramming mixtures

**INTRODUCTION TO REFRACTORY AND INSULATING MATERIALS**

**Classification of Refractories**

Refractories are classified into number of ways on the basis of chemical properties of their constituent substances, their refractoriness, method of manufacture and physical form.

**2) Classification Based on Method of Manufacture**

The refractories can be manufactured in either of the following methods:

- a) Dry Press Process
- b) Fused Cast
- c) Hand Molded
- d) Formed (Normal, Fired or chemical bonded)
- e) Unformed (Monolithic – Plastics, Ramming mass, Gunning, Cast able, Spraying)

**3) Classification Based on Physical Form**

Refractories are classified according to their physical form. These are the shaped and unshaped refractories. The shaped is commonly known as refractory bricks and the unshaped as "monolithic" refractories.

**Shaped Refractories:**

Shaped refractories are those which have fixed shaped when delivered to the user. These are what we call bricks. Brick shapes maybe divided into two: standard shapes and special shapes.

Standards shapes have dimension that are conformed to by most refractory manufacturers and are generally applicable to kilns and furnaces of the same type.

Special shapes are specifically made for particular kilns and furnaces. This may not be applicable to another furnaces or kiln of the same type. Shaped refractories are almost always machine-pressed, thus, high uniformity in properties are expected. Special shapes are most often hand-molded and are expected to exhibit slight variations in properties.

**Unshaped Refractories:**

Unshaped refractories are without definite form and are only given shape upon application. It forms joint less lining and are better known as monolithic refractories. These are categorized as Plastic refractories, ramming mixes, castables, gunning mixes, fettling mixes and mortars.

**Types of refractories**

**8) Monolithic Refractories**

- ☐ Monolithic refractory, the name generally given to all unshaped refractory products, are materials installed as some form of suspension that ultimately harden to form a solid mass.
- ☐ Single piece casts in equipment shape
- ☐ Replacing conventional refractories
- ☐ Advantages

- Elimination of joints
- Faster application
- Heat savings
- Better spalling resistance
- Volume stability
- Easy to transport, handle, install
- Reduced downtime for repairs

Various means are employed in the placement of monolithic refractories like ramming casting, gunniting, spraying etc.

**Types of Monolithic Refractories**

- |  |   |
|--|---|
| <input type="checkbox"/> Castable Refractories | <input type="checkbox"/> Coating Refractories |
| <input type="checkbox"/> Insulating Castables  | <input type="checkbox"/> Mortars              |
| <input type="checkbox"/> Plastic Refractories  | <input type="checkbox"/> Gunning Mixes        |
| <input type="checkbox"/> Ramming Mixes         | <input type="checkbox"/> Fettling Mixes       |
| <input type="checkbox"/> Patching Refractories |   |

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AP 42, FIFTH EDITION, VOLUME I- CHAPTER 11: MINERAL PRODUCTS INDUSTRY**

Refractories are produced in two basic forms, formed objects, and unformed granulated or plastic compositions. The preformed products are called bricks and shapes. These products are used to form the walls, arches, and floor tiles of



various high-temperature process equipment. Unformed compositions include mortars, gunning mixes, castables (refractory concretes), ramming mixes, and plastics. These products are cured in place to form a monolithic, internal structure after application.

#### **INVESTIGATION OF REFRACTORY CONCRETE FAILURE IN FURNACES OF METALS INDUSTRY- K. ANDREEV, S. SINNEMA AND M. HOGENBOOM (1) CERAMICS RESEARCH CENTRE, CORUS RD&T, THE NETHERLANDS**

Refractories are bulk ceramic materials composed of oxide and non-oxide components with a rather coarse grain-matrix structure. Their main application is the lining of industrial furnaces, including liquid metal vessels in the steel and aluminium industry. Due to the complex nature of the loads the linings are built of several layers of refractory materials, which are supported by the steel shell. Refractory concretes, referred to as castables or monolithic refractories, make up approximately 40% of all refractories used in the steel and aluminium industry today. Shaped products (bricks) take the remaining share.

#### **AZOM.COM-REFRACTORIES-AN INTRODUCTION TO THE TYPES OF MONOLITHIC REFRACTORIES**

##### **Background**

Monolithic refractory is the name generally given to all unshaped refractory products, the word monolithic coming from the word monolith meaning 'big stone'. These are materials which are installed as some form of suspension that ultimately harden to form a solid mass.

##### **Market Share**

Monolithic refractories have increased in market share of the total refractories industry over the last two decades and will continue to do so. The main drivers for this have been economic considerations (rapid installation time reducing the down time of a given application, cost of raw materials for their manufacture, less manpower required in their installation), and the availability of skilled people within the industry - as the refractories industry has decayed there are less skilled people available such as refractory brick layers to install conventional products.

##### **Versatility**

Monolithic refractories have a myriad of industrial applications throughout the steel, cement, non-ferrous metallurgical, waste disposal and petrochemical industries. They are available in many forms and different formulations. The main properties of these materials are their respective chemical inertness, mechanical integrity, abrasion resistance and thermal shock resistance at high temperatures.

##### **Composition**

Most monolithic formulations consist of large refractory particulates (an aggregate), fine filler materials (which fill the interparticle voids) and a binder phase (that gels the particulates together in the green state).

##### **Installation and Curing**

Subsequent to the installation and curing, monolithic refractories require a carefully controlled dry-out schedule. This causes the binder, filler and aggregate to sinter producing a strong material. One consequence of not controlling the dry-out schedule is explosive spalling. Explosive spalling of monolithic linings is very problematic to refractory installers and furnace operators, costing significant loss in revenue from down time and repair work. Explosive spalling is believed to be caused by water trapped within the pore structure of cementitious materials, which becomes heated rapidly, forming steam with very high vapour pressure. It is supposed that the steam in combination with thermal stresses developed during the heating causes catastrophic failure of the structure.

##### **Types of Monolithic Refractories**

###### **Castable Refractories**

These are materials which consist of precision graded coarse and fine refractory grains. They are gelled by means of a binder system in the materials green state. Following the heat-up of the material the binder either transforms or volatilises facilitating the formation of a ceramic bond. The most common binder used in castables is HAC (high alumina cement). Other binders that are often used include hydratable aluminas and colloidal silica. Castables are mixed with water and then installed by either pouring or pumping. Placement of the material then requires vibration.

The cement-containing castables are often classified by the amount of cement they contain. Conventional castables can contain around 15-30% cement binder. As refractory technology evolved chemical additives were included in the package to reduce the amount of cement and water the product required - the impact of this was material with improved strengths and durability. Low cement castables contain between about 3-10% weight cement. Ultra low cement castables contain less than 3% cement component.

A specialised type of refractory castable is the free flow castable which is able to be installed without vibration. They require a much lower water addition than traditional castables. This is due to the fact that they have particle packing and dispersing agents which modify the surface chemistry of the fine particles to improve the flow of the material.

Certain castable formulations may be installed via gunning techniques which involves spraying the material through a nozzle at a high speed. At the nozzle, cement accelerators are often added to promote rapid hardening of the material. This technique allows applications to be lined very quickly.

###### **Plastic Refractories**

These are monolithic refractory materials which are tempered with water and/or added with a binder. They have sufficient plasticity to be pounded or rammed into place.

###### **Ramming Refractories**

These materials are very similar to plastic refractories though are much stiffer mixes.

###### **Patching Refractories**

These materials are similar to plastic refractories though have a very soft plasticity allowing them to be pounded into place.

###### **Coating Refractories**

This type of product is used to protect refractory linings usually against chemical attack. Coating refractories are normally intended to cover just the working surface of a lining. They tend to be fairly thin layers.

###### **Refractory Mortars**

Mortars consist of finely ground refractory materials which are then mixed with water to form a paste. They are used for laying and bonding shaped refractory products such as bricks. They are normally applied by trowelling.



### **Insulating Castables**

*Insulating castables are specialised monolithic refractories that are used on the cold face of applications. There are made from lightweight aggregate materials such as vermiculite, perlite, extend-o-spheres, bubble alumina and expanded clay. Their main function is to provide thermal insulation. They are typically of low density and low thermal conductivity. Insulating refractories have inferior mechanical strength to that of conventional castables.*

*Source: CERAM Research Ltd*

Apart from the above information as available from the Internet, I find that the applicant has given certain extracts from the book 'Technology of Monolithic Refractories'. Chapter 2 of this book makes an important observation that 'The 20<sup>th</sup> century invention, monolithic refractories are named "monolithic" to distinguish them from conventional firebrick not only by the absence of shape but also by the method of their preparation. Monolithic refractories are variously referred to as follows :

*Unshaped refractories  
Specialties  
Specialty refractories  
Jointless firebrick*

*Mouldable refractories  
Pliable refractories  
Refractory concrete  
Castable refractories"*

The Book further goes on to enlist the types of refractories thus :

*" Monolithic refractories can be used at site to build furnace wall or repair them, depending upon the furnace type and the location where they are applied. A number of monolithic refractory products are available (Table 2.1)*

**Table 2.1 The variety and features of principal monolithic refractories**

Materials	Features
Castable refractors	Refractory materials consisting of coarse and fine refractory, grains and suitable bonding cement, which are installed by pouring after mixing with water.
Trowellable refractories	A sort of castable refractory installed by trowelling
Plastic refractories	Refractory materials tempered with water and/or added with a binder, which have suitable plasticity to be pounded or rammed into place
Ramming refractories	Similar materials to plastic refractories, which are somewhat more stiff than plastic refractories
Patching refractories	Refractory materials tempered with water and/or added with a binder, which have soft plasticity to be patched into place.
Gunning refractories	Refractory materials consisting of coarse and fine refractory grains and suitable bonding agent, and installed with a gunning machine.
Injection refractories	Refractory materials that can be injected into a furnace in the slurry state.
Vibratable refractories	Refractory materials which are exclusively installed by vibrating cast.
Slinging refractories	Refractory materials which are installed with a slinging machine.
Coating refractories	Refractory materials which are used for coating on the working surface of the lining having a thin thickness
Refractory mortars	Finely ground refractory materials which are trowellable when tempered with water, and are used for laying and bonding refractory shapes.

*As the table shows the name of a refractory product quite often suggests the way it is applied (castable/ramming/gunning; etc.). Sometimes the name may suggest the physical state of a refractory (plastic). Some refractory products are classified according to particular ingredients in them or according to the way they solidify. This may be in addition to the characteristics underlying their names in Table 2.1.*

*The followings are some additional ways by which monolithic refractories may be classified.*

### **SECTION 1. CLASSIFICATION BASED ON PHYSICAL STATE**

*Monolithic refractories are marketed mainly in the powder, plastic or paste (fluid) form, Table 2.2 classifies monolithics according to their physical state.*

**Table 2.2 Classification based on appearance**

Appearance	Main corresponding materials
Powder state	Castables, Trowellable refractories, Gunning refractories, Injection refractories, Coating refractories, Refractory mortars (dry)
Mud state	Plastic refractories, Ramming refractories, Patching refractories
Paste state	Wet refractory mortars, Injection refractories, Coating refractories



## SECTION 2. CLASSIFICATION ACCORDING TO THE METHOD OF APPLICATION

Monolithic refractories are classified also according to the large number of ways in which they are applied.

Table 2.3 classifies monolithics according to the method of their installation.

Table 2.2 Classification based on the installing method

Installing method	Main corresponding materials
Pouring	Castable refractories,
Trowelling	Trowelling refractories, Castable refractories, Refractory mortars
Gunning	Gunning refractories, Some of the Castable refractories, Plastic refractories
Vibrating	Vibratable refractories, Castable refractories
Rounding or Ramming	Plastic refractories, Ramming refractories, Patching refractories
Injecting	Injection refractories,

## SECTION 3. CLASSIFICATION BASED ON SETTING METHOD

A monolithic refractory develops its strength after it is applied. Strength depends on the bonding agent used. This agent is available in a number of types, ranging from organic to inorganic varieties. Setting of a monolithic refractory varies according to the type of bonding agent used. Table 2.4 classifies the refractories according to their setting behavior.

Table 2.4 Classification based on setting characteristics

Setting characteristics	Main corresponding materials
Hydraulic setting	Castable refractories, Gunning refractories
Air setting	Plastic refractories, Ramming refractories, Refractory mortars
Heat setting	Plastic refractories, Ramming refractories, Refractory mortars
Chemical setting	Plastic refractories, Ramming refractories, Castable refractories, Gunning refractories, Refractory mortars "

The applicant has also given extracts from yet another book, Monolithic Refractories by Subrata Banerjee. It states that *Monolithic refractories differ from refractory bricks in that they are not shaped and fired before use, although the chemical and physical properties exhibit similar and sometimes better characteristics.* The Book states the general categories of monolithic refractories to be – *castable, pumpable refractory, injectable, plastic, ramming, gunning, dry vibratable, refractory mortars and coatings.* An overview of all the above information as is accessible from the Internet makes me infer thus –

- *Refractories are either shaped or unshaped.*
- *The most familiar form of shaped refractory materials is the rectangular brick shape.*
- *Unshaped refractories are in powder form as granular material and are known as castables, ramming masses, gunning mix, plastic masses, etc.*
- *The words 'Refractory monolithic' means unshaped refractories.*

It is seen that even the industry understands *unshaped refractories* as '*Refractory monolithics*'. This could be understood from the grouping of the products advertised by the companies :

### • "Products

#### 1. Refractories

##### a) Monolithic refractories:

- *Castables- Conventional and Low cement castables*
- *Acidic ramming mass for induction furnace lining*
- *Basic ramming mass for induction furnace*
- *Wet Ramming mass*
- *Dry ramming mass for EAF*
- *Basic Gunning Mass*
- *Fettling mass for EAF*



- **EBT Fill mass for EAF**
- b) Refractory bricks:**
  - IS-6 & IS-8 bricks (fireclay based)
  - Ladle pouring refractories like ladle sleeves, nozzles and stopper head
  - High Density High Grog bricks
  - 60-85%Al<sub>2</sub>O<sub>3</sub> High Alumina
  - MgO-C bricks for ladle, EAF and converter(Chinese origin)
  - Acid Resistance bricks
  - Ladle and collector nozzle
  - Slide plates
  - Tundish Zircon nozzles
  - Insulation bricks
  - Blast furnace refractories(Chinese origin)
  - Coke oven refractories(Chinese origin)
  - AZS blocks(Chinese origin)
- c) Pre-cast and pre-fired(PCPF) shapes like burner blocks, well blocks etc.**

- **Our refractory monolithics are available in three distinct varieties: insulating monolithics, dense monolithics, and special duty monolithics.** Depending on composition, water content, and other factors, they can be cast, gunned, rammed, poured, plastered, and (in some compositions) pumped and shot-creted. Insulating monolithics are lightweight and feature very low thermal conductivity, resulting in significant fuel savings, less need for support steelwork, and increased energy efficiency. These monolithics feature ease of installation, including easy flow characteristics and low gunite rebound loss for time and material savings. They are available in gunite versions and several can be installed by shot-creting or pumping. Dense monolithics are engineered formulations designed to meet specific property requirements of industrial furnace operators. They are economical, have good strength throughout their temperature ranges, and are available in both dual-use cast/gun and special gunning formulations. Special duty monolithics are designed for more critical applications. Specifically enhanced properties allow them to outperform conventional monolithics. These high-technology materials include low-cement gunning and casting refractories, no-cement monolithics, plastics for gunning and casting, and very high-alumina-content monolithics. Enhanced properties, such as extra high strength and resistance to chemical attack and abrasion, provide long service life with low maintenance.
- **Refractories are materials that are non-metallic, heat resistant and are most often used in the linings of furnaces, reactors, and other units that produce a large amount of heat.** ..... The term 'refractories' refers to a broad spectrum of different materials that have the characteristics previously referred to. They also must be able to provide the containment of substances at those high temperatures as well. The composition of a specific type of refractory material will depend upon how it is going to be used. Each refractory material may be different, and take on a wide variety of different shapes depending upon the number of different factors. Typically, refractories are going to be one of three different types of refractory materials; brick shapes, fiber or monolithic refractories. Typically, the brick shaped refractories are going to be utilized in most furnaces, while monolithic refractories have very specific uses. Most refractories resemble a brick shape, but here at ... we work with companies to ensure that we are able to deliver a high-quality finished product, that is customized to the shape and style that you are looking for."

The applicant has also given Certificates by the following manufacturers in the areas of Steel, Cement etc. who as the applicant states are the largest users of refractory products. The certification is that the unshaped refractory products manufactured by the applicant are nothing but 'Refractory Monolithics'.

Sr. No.	Name of the Organisation	Certifier Designation
1	Tata Steel	Chief Refractory – Technology Group
2	ACC	General Manager – Production
3	Bhushan Power and Steel	Sr. DGM-Refractory
4	JSW	General Manager – Refractories
5	Birla Corporation	Sr. Vice President(Production & Environment)
6	Jaiprakash Associates (Jaypee)	Sr.GM (Prod. & QC)
7	Prism Cement	Asst Vice President (Process)
8	Dalmia Cement	Officer Purchase
9	Indian Metal & Ferro Alloys Ltd	Authorised Signatory
10	Electrotherm	AGM - Purchase



From all the information as available, it is seen that refractory monolithics are the unshaped refractories available in the form of castables, ramming masses, gunning mix, plastic masses, etc. The present products are in the form of High Purity Dense Castable, Low Cement Castable, Magnetic Ramming Mass and Plastics. The applicant has given the Product Data Sheet which brings out the character of the products thus :

1. **Whyheat-A Supreme** is of the type of 'High Alumina Dense Castable' and the major ingredients are alumina, iron oxide and calcium oxide. It has a grain size of 5 mm. and service temperature of 1650<sup>0</sup> C and water required for casting is 8.5 to 10.5%. It is delivered in dry state. The installation is by vibration casting.
2. **Whyheat-A** is of the type of '90% Alumina Dense Castable' and the major ingredients are alumina, iron oxide and calcium oxide. with grain size of 5 mm and maximum service temperature of 1700<sup>0</sup> C and water required for casting is 8.00 to 10.00%. It is delivered in dry state. The installation is by vibration casting.
3. **Accmon 80 Spl** is of the type of '80% Alumina LC(Low Cement) Castable' and the major ingredients are alumina, iron oxide and calcium oxide. It has a maximum grain size of 6 mm having maximum service temperature of 1650<sup>0</sup> C and water requirement for casting is 5.0 to 5.5%. It is delivered in dry state. The installation is by vibration casting.
4. **Accram M-84** is a '80 - 84%MgO Ramming Mass (Magnesite Ramming Mass) and the major ingredients are magnesium oxide and iron oxide. It has a maximum grain size of 5 mm having maximum service temperature of 1700<sup>0</sup> C and water requirement for application is 5.00 to 7.00%. It is delivered in dry state. The installation is by vibration casting.
5. **Accplast-55** is in plastic form of the type of '55% Alumina plastic' and the major ingredients are alumina and iron oxide. It has a maximum grain size 6 mm and maximum service temperature at 1600<sup>0</sup> C with water content of 10.00 to 12.00%. Delivered in moistened and rammable state. The installation is by pneumatic ramming.
6. **Accplast 80 AL** is in plastic form of the type of '80% Alumina plastic for use in molten aluminium contact' and the major ingredients are alumina and iron oxide. It has a maximum service temperature 1450<sup>0</sup> C and water content of 6.0 to 9.0%. Delivered in moistened and rammable state. The installation is pneumatic ramming.

A section about 'Thermal Properties' in the Product Data sheet contains information about 'Refractoriness'. The Test Procedure mentioned here are BIS 1528 Part 1 and BIS 10570. The test methods prescribed in BIS 10570 standard are intended to be used for assessment of the quality of refractory castables as well as for checking their conformity to the standard. BIS 1528-1 (2010) is about methods of sampling and physical tests for refractory materials. A segment of this Standard about 'preparation of samples' speaks about methods for 'Fired shapes' and 'Dry monolithic materials'. The discussion on the latter states thus -

*"Samples of unshaped materials, such as, plastic refractories, ramming materials and refractory cement shall be shaped and fired in a manner appropriate to the material and its condition of use; the firing temperature shall be stated in the test report."*

Thus, the BIS reports also conforms to the view that *unshaped materials, such as, plastic refractories, ramming materials* are the monolithic refractories.

Monolithic refractories are mechanical mixtures of refractory materials that serve as aggregates, binders, mineralizers or other properties that are desired in the product. The major ingredients of the impugned products are alumina, iron oxide, calcium oxide, etc. We have seen above the major ingredients of the impugned products. A perusal of the above information of the products, which are delivered either in dry or moistened state, being castables, ramming masses or plastics conforms to the general perception about the forms in which the unshaped refractories better known as 'refractory monolithics', are available. In view of the above, the impugned products would get covered by the words 'Refractory monolithic' as inserted in the entry C-3. In view of the peculiar setting of the



entry accomodating the unshaped refractories within its ambit, the aspect about the other products of the entry being in shaped form needs no deliberation thereon. The applicant has also furnished Certificates by the following :

1. Sh. Arup Ghosh, Chief Scientist & Head Refractory Division, CSIR - Central Glass & Ceramic Research Institute
2. Sh. Swadesh K Pratihari, Head, Department of Ceramic Engineering, National Institute of Technology, Rourkela
3. Sh. A. Dasgupta, Senior Executive Officer, Indian Refractory Makers Association

certifying thus -

*This is to certify that the "unshaped refractory products" (i.e in granular/powder form of Refractory Products) are nothing but "Refractory Monolithic" products. In terms of Technical & Common understanding, refractory products that are sold & transported in unshaped form (i.e in granular/powder for) are only considered as Refractory Monolithic and products with any other form are not called Refractory Monolithics.*

The Technical opinion as expressed above substantiates the data as available from the Internet. With the situation being so, my inferences about 'refractory monolithics' and the impugned products, as made above, stand well reinforced. However, I would have to touch one more aspect and which is the classification under Central Excise. This is necessary as a point relating thereto was raised by the departmental authority handling the case of the applicant. The impugned products are covered under Central Excise Tariff Heading (CETH) 38160000. The description against the same is thus :

3816 00 00 Refractory cements, mortars, concretes and similar compositions, other than products of heading 3801

There is Chapter 69 which is for 'Ceramic Products'. Headings 6902 & 6903 of this chapter are thus :

6902	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths
6903	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meals or of similar siliceous earths
6903 10	- Containing by weight more than 50% of graphite or other carbon or of a mixture or compound of alumina and of silica (SiO <sub>2</sub> ) :
6903 20	- Containing by weight more than 50% of alumina (Al <sub>2</sub> O <sub>3</sub> ) or of a mixture of these products :
6903 90	- Other :
6903 90 10 - - -	Zircon or zircon-mullite refractories
6903 90 20 - - -	Basalt tiles
6903 90 30 - - -	Ceramic fibres
6903 90 40 - - -	Monolithics or castables (fire-clay, basic, silica, high alumina, insulating)

Chapter 69 is for ceramic products which are products having a definite shape. The monolithics or castables referred to in Chapter 69 would be of the nature of *retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods* as described in the Heading. The entry under consideration in the present proceedings is "All kinds of bricks including fly ash bricks and refractory bricks and monolithics, asphaltic roofing tiles, earthen roofing tiles". The entry isn't surely meant for the ceramic goods as *retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods*. It is also seen that refractory bricks i.e the shaped goods are



covered by the Chapter 69. The *prima facie* opinion as coming from a perusal of the CETH 6903 90 40 is that the products of this Heading are not the unshaped refractories as understood hereinabove. However, since the applicant's products are classified under CETH 3816 whereas monolithics find classified under 6903, I would refer to the Harmonized Commodity Description and Coding System Explanatory Notes (HSN) to understand the scope of the Heading 3816. The HSN Notes say thus -

*"This heading covers certain preparations (e.g., for furnace linings) with a basis of such refractory materials as chamotte and dinas earths, crushed or ground corundum, powdered quartzites, chalk, calcined dolomite, with an added refractory binder (for example, sodium silicate, magnesium or zinc fluosilicates). Many of the products of this heading also contain non-refractory binders such as hydraulic binding agents. The heading also covers refractory compositions with a basis of silica for the manufacture of dental or jewellery moulds by the lost wax process.*

*The heading further covers refractory concretes consisting of mixtures of heat-resistant hydraulic cements (e.g., aluminous cements) and refractory aggregates used for the foundation of furnaces, coke ovens, etc., or for patching furnace linings as well as the following :*

- (a) *Compositions known as refractory "plastics", which are products sold as a dampened mass often consisting of a refractory aggregate, clay and minor additives.*
- (b) *Ramming mixes, other than dolomite ramming mixes, which are similar in composition to the products mentioned in (a) above and which, when applied by hand-held pneumatic rammers, form a dense coating or filling.*
- (c) *Gunning mixes, which are refractory aggregates mixed with hydraulic setting or other binders, applied to furnace linings, sometimes even when these are hot, by special guns which project the mix through a nozzle using compressed air.*

*The heading does not cover :*

- (a) *Dolomite ramming mixes (heading 25.18)*
- (b) *Carbonaceous pastes of heading 38.01."*

I have reproduced hereinafter the data as available from the various sources. We have seen as to what the words 'refractory monolithics' connote. A perusal of the HSN Notes reveal unambiguously that the heading 3816 covers the unshaped monolithic refractories as are available in the form of castables, ramming masses, etc. Therefore, the classification of the impugned products under the Central Excise Heading 3816 supports the general and technical understanding of the products which have been sought to be claimed as covered by the words 'refractory monolithics'. As to the description 'monolithics' as appearing in CETH 6903, then it is seen that these are articles having a definite shape. This could be corroborated from the HSN Notes of this Heading -

*"This heading covers all refractory ceramic goods not specified or included in the preceding headings.*

*These articles include :*

- (1) *Articles which, unlike the refractory products of heading 69.02, are in many cases not permanent fixtures, such as retorts, reaction vessels, crucibles, cupels and similar articles for industrial or laboratory use, muffles, nozzles, plugs, burner jets and similar parts of furnaces; saggars, stands and other kiln furniture to support or separate pottery during firing; sheaths and rods; stands for crucibles; ingot moulds; etc.*
- (2) *Tubing, piping (including runways in the form of half-cylinders) and angles, bends and similar tube or pipe fittings, even if intended for use as permanent fixtures in construction work.*

*The heading, does not, however, include Seger cones (ceramic firing testers) (see Explanatory Note to heading 38.24); these are not fired after shaping"*

All the data as available from the published material as well as the information on the Internet suggests that the 'Refractory Monolithics' is a category of refractory goods in unshaped form which are available as castables, ramming masses, gunning mixes, etc. I have to hasten to observe herein that a reference to the CETH 3816 would not mean that all the products of this Heading would fall under the schedule entry C-3 of the MVAT Act, 2002. The impugned products are the 'Refractory monolithics' and would therefore,



merit classification under the schedule entry C-3 of the MVAT Act,2002.

Since, the claim as regard the applicable schedule entry is found acceptable, there arises no occasion to deal with the arguments and case laws cited by the applicant as well as the request for prospective effect made by the applicant.

05. In view of the deliberations held hereinabove, it is determined thus -

### **ORDER**

(under section 56(1)(e) and section-56(2) of the MVAT Act, 2002)

No. DDQ 11/2009/Adm-3/38/ B- 3

Mumbai, dt. 16/10/2014

The schedule entry under the Maharashtra Value Added Tax Act,2002 and the rate of tax on the products sold in the following invoices is thus :

Sr. no.	Invoice No.	Date	Product	Schedule Entry	Rate of tax
1	00786	07.06.14	WHYTHER A	C-3	5%
2	00786	07.06.14	WHYTHER A (SUPREME)		
3	00739	04.06.14	ACCMON 80 (special)		
4	00707	31.05.14	ACCRAM MS-84		
5	03187	26.12.13	ACCPLAST 55		
6	00797	07.06.14	ACCPLAST 80 AL		



  
(DR. NITIN KAREER)

COMMISSIONER OF SALES TAX,  
MAHARASHTRA STATE, MUMBAI