CRITERIA FOR FURNACE (OR KILN) DESIGN AND SELECTION OF REFRACTORIES

The primary function of any refractory material is to withstand high temperature in a hostile environment. However, in actual application it is required to perform many other functions depending upon the place of use and prevailing service conditions.

The general requirement which a refractory material is to fulfill may be summarized as follows:

1. Ability to withstand high temperature.

2. Ability to withstand temperature fluctuation.

3. Ability to withstand the actions of processing materials and product of combustion.

4. Ability to withstand load under high temperature.

5. Ability to withstand impact and abrasion of solid, liquid and dust laden gases moving with high speed.

6. The refractory material should be volume stable.

7. It should not contaminate the finished product.

8. The refractory material should have low co-efficient of thermal expansion.

9. It should not conduct much heat.

For a proper design of any refractory lining system it is essential that the complete information of furnace or kiln type and prevailing service conditions are available.

The most important operational data required for the selection of refractories are as follows:

Furnace / Kiln Type : For which industry the furnace or the kiln is to be used.

: Details of process to be adopted. Will the refractory material come in direct contact with slag, metal, dust, fluxing agent, gas or flame? Which part of the furnace or kiln will be subjected to the destructive actions of the above elements, etc.

: Type of fuel to be used for generation of heat energy. How the furnace will be heated.

: How the furnace (kiln) will be operated: continuous or intermittent. What is the extent of temperature fluctuation and over what period of time. To what extent the refractories will be exposed to thermal shock.

Operation - Temperature : What will be the highest temperature to which refractories will be exposed. What will be the peaks.

Limiting - Temperature : What are the maximum and minimum temperatures of the furnace or kiln design components e.g. steel shell temperature etc.

Heat Loss : What heat loss will take place? Is the heat to be conducted through refractories or retained within the furnace?

Surrounding Conditions : What are the surrounding conditions such as heat flux calculations, influence of any adjacent plant or component, maximum and minimum ambient temperatures, wind speed, radiation co-efficient etc.

Furnace Atmosphere : Is it neutral, oxidizing, reducing or changing?

Furnace Pressure : What operation pressure is expected? Is the furnace part under suction or under positive pressure.

In actual situation the refractories may have to work under some or all of the above conditions. They may act simultaneously and demand suitable refractories to withstand the destructive

forces. No single refractory material can satisfy the entire requirement. Hence, a compromise is made and the most demanding requirements are first met at the cost of other lesser requirements. For example, in a hot air or gas carrying system the thermal conductivity would be the vital criteria. Therefore from every saving point of view insulating properties of the refractory material becomes more important than other properties for design considerations.

Source : http://viewforyou.blogspot.in/2010/03/criteria-for-furnace-or-kiln-design-and.html