"Failures can be avoided by selection of right quality of refractory bricks"

- **Sumanta Mukhopadhyay**, Head – Sales & Marketing, Cement Business Unit, Dalmia-OCL

Kiln being the heart of the plant, what kind of products you are offering for it? What different kind of bricks you offer for the cement industry?

We offer bricks and castables for the entire pyro system of cement manufacturing process. This includes the preheater, calciner, kiln, cooler and tertiary air duct. In preheater area, the charge is heated up. This part consists of various stages of cyclones and ducts. Both brick and castables are used for lining the preheater area.

Calciner is the equipment, which heats up the charge in the preheater. This is also lined with both bricks and castables. Kiln is the heart of the pyro process where charge gets converted into clinker. This is lined entirely with bricks. Castable is used only in two areas – tip casting and burner lance. Cooler and tertiary air duct are the last parts of the pyro system. Both are lined with both bricks and castables.

Please elaborate on different types of bricks used in a rotary kiln.

Brick selection for a kiln depends on factors such as kiln size and production load on the kiln. For large kilns with high production loads, [sometimes] it is necessary to use basic bricks in the burning zone. Different qualities of alumina bricks are used for the rest of the kiln. Kilns with moderate production loads are generally lined with special alumina and normal alumina bricks. Nowadays, increasing usage of alternative fuels pose challenges like coating formation, ring formation, etc. Special alumina bricks are available to solve specific problems. Special bricks of very low thermal conductivity are used towards inlet area to reduce heat losses due to thermal radiation.

Dalmia-OCL manufactures specialised range of bricks for cement kilns. Our product range includes basic bricks, special alumina bricks, normal alumina bricks as well as castables for tip casting and burner lance. We study the process and offer optimised lining concepts for maximising refractory performance.

What is the life expected at burning zone as a thumb rule?

Normal life expectancy for burning zone is about one year. Cement plants want to take only one shutdown in a year when the burning zone bricks are changed.

What can be the general causes of failure? How it could be avoided?

Performance of refractory broadly depends on three factors – refractory selection, installation and usage conditions. Assuming first two conditions were fulfilled as per requirement, the various stresses in usage condition cause refractory failure, such as chemical, thermal or mechanical.

Most common chemical stresses come from alkali or sulphur vapours present in the kiln atmosphere. Bushy burner flame, improperly centred burner flame or unstable coating condition might cause thermal stress on the refractories. Shell deformation, shell ovality at tyre area or axial thrust near retainer area

might cause mechanical stress on the lining.

Failures can be avoided by selection of right quality of refractory bricks or castables with sufficient resistance towards the stress expected at the area of usage. Proper installation procedure and stable usage conditions also help to avoid unforeseen stoppages due to refractory failures. Every stoppage is stressful for the refractory lining. Continuous kiln operation always ensures better lining life.

Tell us something about the coatings formed on brick lining in the burning zone. How is it formed?

Most common and desirable coating in the burning zone is cement clinker coating. Liquid phase starts appearing the upper transition zone as a part of clinker formation. Charge gets mixed with this liquid and forms semisolid mud like substance, which sticks to the refractory lining in the burning zone. This coating is desirable as it reduces thermal radiation from the kiln, thereby saves fuel and also protects the burning zone bricks from getting exposed to flame.

There is another type of coating that is undesirable. Nowadays most of the kilns are being fired with pet coke, which contains 6 to 8 per cent sulphur. This sulphur reacts with lime and forms calcium sulphate or sulphur spurrite at the calcining zone. Very often deposition of sulphur spurrite on the calcining zone tends to form a dam ring blocking smooth passage of charge from inlet to the burning zone. Often kilns need to be stopped to break the dam rings manually and normal operation is hampered.

What types of refractories are used in preheater and calciner?

Preheaters and calciners are lined with both alumina bricks and castables. Preheaters have cyclones located at different stages from bottom to top, which are connected by ducts. Conditions are more severe towards the bottom where temperatures are higher and atmosphere is laden with dust particles therefore more abrasive for the refractories.

Chemical corrosion is also higher at the bottom cyclones as different gases coming out from kiln inlet try to go up the preheater; get mixed with charge coming down the preheater and go back to the kiln along with charge. Therefore bottom cyclones and ducts need to be lined with superior quality of bricks and castables having high resistance to chemical corrosion and abrasion. Usage condition is comparatively less severe as we go up the preheater towards the top.

Similarly superior grades of alumina bricks and castables are used in the calciner where pet coke and alternative fuels are generally fired to calcine the charge inside the preheater. Temperature in this area often ranges from 900 to 1,100 degree Celsius. Lining should therefore have high refractoriness as well as high resistance to chemical corrosion.

What kind of refractories is used for coolers?

Both alumina bricks and castables are used in the cooler area. For cooler, most critical part is the area towards the kiln. These include the front wall, bull nose and first compartment area. Here temperature and abrasion both are much higher than the rest of the cooler. Very special quality alumina bricks and castables with high resistance to thermal shock and abrasion are used in critical zones of the cooler. Depending on severity of working condition, refractories are selected for the rest of the areas.

Anywhere in the plant if refractory bricks are used? What is the location and application?

Insulating bricks are generally used in the kiln from calcining zone to inlet area to save fuel by reducing heat losses.

What is tip casting and what kind of refractories are used for it?

Tip casting refers to the tip of the kiln at the outlet side. Generally this area is fitted with outlet sector plates. This area being outermost part of the kiln is highly prone to thermal shock at every stoppage. It also undergoes continuous abrasion from falling clinkers and dust laden secondary air. Generally silicon carbide or and alusite-based castables having high refractoriness; thermal shock resistance and abrasion resistance are selected for this area.