ABSTRACT

Concrete is one of the mankind’s most versatile and useful building materials. It is used for special industrial structures such as, nuclear reactors, pressure vessels, chimneys, storage tanks for hot crude oil & hot water, and coal gasification & liquefaction vessels. Under normal conditions concrete structures are subjected to a range of temperatures, not more than that imposed by the environmental conditions. Concrete is subjected to elevated temperature in case of accidental fires in tunnels or buildings, furnaces and reactors, oil and gas, power industries and chimneys, jet parking aprons, rocket launching pads etc.

The exposure of concrete to high temperatures as mentioned above leads to undesirable structural quality deterioration. Hardened cement paste plays a key role in the high temperature deterioration process. The hardened cement paste undergoes physical changes and chemical reactions such as loss of water (free, adsorbed and chemically bound) loss of strength, increase in porosity, transformation of C-S-H gel, dehydration of CH and ettringite, thermal cracking due to incompatibility between the aggregate and cement paste etc. It was found that the loss in structure quality of concrete due to elevated temperature is influenced by the degradation of hardened cement paste.

Hence, in this work an attempt has been made to study the performance of cement mortars with the addition of refractory chemicals at elevated temperatures of 100, 200, 300, 400, 500, 600 and 800 °C for a sustained duration of 2, 4 and 6 hours. The changes in properties such as compressive strength, thermal conductivity, and water absorption have been studied. It was found that there is reduction in properties beyond 100 °C for cement mortars. The blended mortars experienced the reduction only after 200 °C.
The thermal conductivity and water absorption studies revealed the extent of deterioration of the matrix with temperature. It also explains the changes in total porosity.

The micro structural studies helped in identifying the mineralogical changes occurring in cement mortars at elevated temperature due to the addition of refractory chemicals.

These investigations have enabled the identification of suitable refractory chemicals which exhibits better performance at elevated temperature when blended with cement mortars.