Abstract

Evolution of concrete is continuously taking place to meet the ever-growing demands of the construction industry. Self compacting concrete (SCC) has emerged as a result of this demand to overcome the scarcity of labour. SCC is widely replacing normal vibrated concrete (NVC) these days owing to its advantages such as homogeneity of the mix, filling ability even in heavily congested reinforcement, smooth finish, reduction in construction time etc.

The ingredients used for SCC is the same as that of the NVC. But the proportioning of ingredients to achieve self compactability alters the microstructure of SCC which in turn affects the mechanical and fracture properties. Moreover, the mineral admixtures such as fly ash and silica fume when used for improving the workability of SCC help in the development of the microstructural skeleton. In this study, three SCC mixes SCC1- made with only cement, SCC2 - with fly ash in addition to cement and SCC3 - with fly ash and silica fume in addition to cement for achieving normal, medium and high strength SCC respectively are cast. The microstructural changes in SCC with and without mineral admixtures over a period of time are studied using different techniques such as scanning electron microscopy (SEM), energy dispersive spectrometer (EDS) and X-ray diffraction (XRD).

The modification of mechanical properties at microstructural level brings difference in the behavior at macro level. Hence in this study, the mechanical properties at microstructural are obtained by using microindentation test and are scaled up to the macro level to predict the influence of micromechanical properties on macro response. The fracture properties of SCC is considered to be the interest of this study and is carried out with the help of advanced techniques such as acoustic emission (AE) and digital image correlation (DIC).

From the various studies carried out, it is inferred that the mixes with mineral admixtures behave in a more brittle manner when compared to mix having no mineral admixture. It is also observed that class ‘F’ fly ash hydrates at a slow pace and the strength gain is observed after 28 days and even beyond 90 days. Hence, it is concluded that it is appropriate to consider the strength at 90 days instead of 28 days for a SCC mix with class ‘F’ fly ash. Silica fume on the other hand is observed to result in a more rapid gain in strength and this can partially offset the delay in strength gain due to fly ash.