**Fracture and fatigue of a self-compacting version of CARDIFRC mix II**

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| A self-compacting and industrially competitive version of CARDIFRC mix II has been developed. In this paper we describe the mechanical, fracture and fatigue performance of this ultra-high performance concrete (UHPC). The fracture performance is characterised in terms of size-independent fracture energy obtained by the boundary effect model and the corresponding bilinear stress-crack opening relationship obtained by using the non-linear hinge. For this, three-point bend tests were conducted on specimens one half of which had a shallow starter notch (notch to depth ratio 0.1) while the other half had a deep starter notch (notch to depth ratio 0.6). It was found that the size-independent specific fracture energy of the UHPC is in excess of 36000 N/m.  Fatigue test under tensile cyclic loading was conducted on un-notched three point bend strips. Tests were performed in the sinusoidal load ranges between 0.6 – 4 kN, 0.6- 4.5 kN, and 0.6 – 5.5 kN, corresponding to 9.69 - 64.62%, 9.69 - 72.70% and 9.69 - 88.85% of the static three-point flexural strength. This meant that the mean stress level on the specimens during cyclic loading increased with the increase in the upper load limit. This has a marked effect on reducing the fatigue life. The cyclic load-central deflection traces of the specimens were recorded every minute, i.e. every 300 cycles. From these, the change in compliance of the specimens could be calculated.  It was found that the endurance limit of this is around 64% of its static three point flexural strength at a mean stress level of 27.5% of this strength. This corresponds to an endurance limit close to 80% of the static three point flexural strength at zero mean stress. **Keywords:** UHPC; Self-compacting; Bi-linear stress-crack opening relation; fatigue life; endurance limit. |