Effect of High Strain Rate on Compressive Behavior of High Performance Fiber-Reinforced Cement Composites

The main objective of this project is to have a better understanding on the behavior of fiber reinforced cement composites when subjected to high strain rate compressive loading. Behavior of two strain-hardening cement composites (SHCCs) and two fiber-reinforced high-strength concretes (FRHSCs) of similar compressive strengths is investigated with static, intermediate, and high strain rate compressive loadings. One of the SHCCs was reinforced with 2% of polyvinyl alcohol fibers by volume and had a compressive strength of 64 MPa. The other was reinforced with 0.5% of steel plus 1.5% of polyethylene fibers by volume and had a compressive strength of 83 MPa. Both FRHSCs were reinforced with 0.5% of steel fibers. The strain rates from 10^{-5} to about 300 s^{-1} are generated by a hydraulic testing machine and a split Hopkinson pressure bar system.

The Dynamic Increase Factor (DIF_{fc}), the ratio of the compressive strength under dynamic loading to that under static loading, is determined. Experimental results indicate that the fiber content has a significant effect on the DIF_{fc} value. At a similar strain rate level, the damage of the SHCC specimens is less severe than that of the FRHSC specimens, and the DIF_{fc} of the former is lower than that of the latter.

Figure 1: Split Hopkinson pressure bar system used for testing specimens at high strain rates, from about 30 to 300 s^{-1}

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