

The Synergistic Effects of Different Types of Hybridized Synthetic Fibers on Concrete Post-crack Residual Strength

ABSTRACT

The use of fibers in cement composites has been shown to improve the mechanical properties of concrete through the fiber-bridging effect, which implies the fiber's crack-resisting property. Additionally, the combination of two or more different fibers in the concrete mixture yielded better strength than the individual fibers due to its more versatile applications. Therefore, this study was conducted to investigate the combination of multiple synthetic fibers to improve the concrete residual strength and evaluate the hybridization synergistic effect. Ferro macro-sized fiber (FF) as the primary load-bearing fiber and four different secondary synthetic microfibers comprising Ultra-Net (UN), Super-Net (SN), Econo-Net (EN), and Nylo-Mono (NM) were utilized to develop a total of 16 hybrid fiber reinforced concrete (HyFRC) combinations and the performance were compared against their single-fiber counterpart. The tensile strength, bonding power, physical form, length, and volume fraction of the fibers were measured under the ASTM C1399 test standard in order to calculate the average residual strength (ARS) of concrete in the post-cracking region as well as to assess the synergistic effect of the fiber combination. The results recorded positive fiber synergy for all specimens tested. In addition, the Ferro-Nylo, Ferro-Super, Ferro-Econo, and Ferro-Ultra hybrids improved the ARS compared to the controlled specimens by 20.41, 10.2, 7.48, and 6.12%, respectively.