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The damage self-sensing response of ultra-high-performance fiber-reinforced concrete in tension

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In this study, the change of electrical resistivity in Ultra-High-Performance Fiber-Reinforced Concrete (UHPFRCs) in tension was investigated. UHPFRCs have shown significant reduction in their electrical resistivity after first cracking until post cracking tensile strength point during their unique tensile strain-hardening. An experimental program was designed to investigate the change in the electrical resistivity of UHPFRCs blending 1 vol.% long (L=30 mm, D=0.3 mm) and 1 vol.% short (L=19 mm, D=0.2 mm) smooth steel fibers. To measure the electrical resistivity, a layer of silver paste was first applied onto the surface of specimens and then copper tapes were attached on the silver paste. The distance between two outsides electrodes for input current (10 μA) was 110 mm while that between two electrodes for voltage measurement was 50 mm. The specimen was subjected to direct tension using a universal testing machine (UTM). The speed of the machine displacement was 1.0 mm/min. The reduction in the electrical resistivity of UHP-FRCs under direct tension until post cracking tensile strength was 437.7 kΩ·cm, and it was found to be significantly higher than those (13.7 and 149.7 kΩ·cm) of strain hardening steel-fiber reinforced concretes (SH-SFRCs) with lower strength matrices (117 and 152 MPa), respectively. The potential damage-sensing capacity of UHPFRCs, in addition to the high mechanical resistance of UHPFRCs, would be considerably favorable for future structural health monitoring system as well.

Biography

Dong Joo Kim has his expertise in the development and evaluation of high performance cement based construction materials with high tensile strength, ductility and energy absorption capacity in addition to self-sensing or self-healing capability. He has obtained his PhD degree from the University of Michigan, Ann Arbor in 2009 and since then he has been an Assistant and Associate Professor in Sejong University, South Korea.

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