

Mode II Fracture Toughness of Hybrid Fiber Reinforced Concrete

Authors : H. S. S Abou El-Mal, A. S. Sherbini, H. E. M. Sallam

Abstract : Mode II fracture toughness (KIIc) of fiber reinforced concrete has been widely investigated under various patterns of testing geometries. The effect of fiber type, concrete matrix properties, and testing mechanisms were extensively studied. The area of hybrid fiber addition shows a lack of reported research data. In this paper an experimental investigation of hybrid fiber embedded in high strength concrete matrix is reported. Three different types of fibers; namely steel (S), glass (G), and polypropylene (PP) fibers were mixed together in four hybridization patterns, (S/G), (S/PP), (G/PP), (S/G/PP) with constant cumulative volume fraction (V_f) of 1.5%. The concrete matrix properties were kept the same for all hybrid fiber reinforced concrete patterns. In an attempt to estimate a fairly accepted value of fracture toughness KIIc, four testing geometries and loading types are employed in this investigation. Four point shear, Brazilian notched disc, double notched cube, and double edge notched specimens are investigated in a trial to avoid the limitations and sensitivity of each test regarding geometry, size effect, constraint condition, and the crack length to specimen width ratio a/w . The addition of all hybridization patterns of fiber reduced the compressive strength and increased mode II fracture toughness in pure mode II tests. Mode II fracture toughness of concrete KIIc decreased with the increment of a/w ratio for all concretes and test geometries. Mode II fracture toughness KIIc is found to be sensitive to the hybridization patterns of fiber. The (S/PP) hybridization pattern showed higher values than all other patterns, while the (S/G/PP) showed insignificant enhancement on mode II fracture toughness (KIIc). Four point shear (4PS) test set up reflects the most reliable values of mode II fracture toughness KIIc of concrete. Mode II fracture toughness KIIc of concrete couldn't be assumed as a real material property.

Keywords : fiber reinforced concrete, Hybrid fiber, Mode II fracture toughness, testing geometry

Conference Title : ICRSS 2015 : International Conference on Reliability and Structural Safety

Conference Location : Istanbul, Türkiye

Conference Dates : July 29-30, 2015