Cement Mortar Reinforced with Polypropylene Mesh

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Abstract: Concrete is one of the world's most widely used building materials for many reasons including: relatively low cost, moldability, and high compressive strength. This high compressive strength is perfect for most construction applications where the building is subjected to constant and well known static forces. However, due to concrete's brittle nature, crack formation and ultimately failure will occur when it is exposed to dynamic or tensile loading; concrete is often subjected to such conditions in highway and military applications. Polymeric fibers, namely Polypropylene (PP), are often added to the concrete mix in order to promote toughness and impact resistance, improving the survivability of concrete under such loading conditions. In this work we consider PP mesh in lieu of fibers as impact modifier for cement based structures. In brief, we have studied the effect of the mesh addition to cement mortar on physical properties, including impact resistance. It is suggested that mesh reinforcement can offer better improvements to toughness due to its connectivity and, therefore, ability to serve as macro scale reinforcement. Samples were prepared using a cement mortar mixture of constant composition (large aggregates were excluded due to the cm-scale sample size) and reinforcement with ~ 2% by volume of varying sized PP meshes. The samples were subjected to compression, tensile splitting, and impact testing in order to quantify their mechanical properties. The effect of mesh geometry and distribution on sample properties were investigated. Additionally, the properties of mesh reinforced samples were compared to those of fiber reinforced and non-reinforced samples. In the future, hybrid geometry reinforcements will be investigated alongside with mechanical modeling of the composite systems.