Effect of carbon nanotubes reinforcement on mechanical and electrical properties of mortar for restoration of monuments of cultural heritage

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The effect of multi-wall carbon nanotubes addition as a reinforcement in mortar that is currently used in applications such as restoration of monuments of cultural heritage was investigated. The incorporation of the nano-reinforcements in different concentrations is expected to increase the mortar's mechanical properties [1, 2]. Furthermore, the addition of the nano-structures at concentrations above the percolation threshold might enhance its monitoring ability via the electrical resistance change method. Traditional approaches for structural health monitoring of Historical Monument components currently focuses on strain gauges that can be applied on the outer material's surface and therefore cannot detect any strain changes or induced damage inside the material/structure. The incorporation of electrically conductive carbon nanotubes, is expected to improve the mechanical performance of mortars and supply them with improved electrical properties.

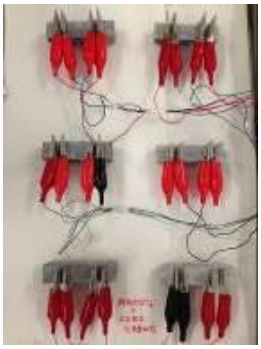
(a)  **(b)** 

Figure 1: (a) Experimental three-point bending test set-up of 0.2% MWCNTs mortar and (b) macro-photograph of the electrical resistance testing of the prismatic samples.

The present work primarily investigates the efficient dispersion of multi-wall carbon nanotubes (MWCNTs) in the cementitious material using several different types of surfactants at various concentrations. The MWCNTs/surfactant solutions were sonicated using a titanium probe. The mortars were mixed using a standard mixer, following the ASTM specifications. Compression and three-point bending tests were performed on intact and notched specimens, respectively. During the tests, time, force and displacement were continuously monitored and recorded. Preliminary results indicate that sodium dodecyl benzene sulfonate (SDBS), a surfactant typically used for the dispersion of MWCNTs in polymers [3], is not suitable for use in cementitious materials. The use of a chemical admixture, compatible with the cement, is proposed.

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References

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