Effect of environmental loading on the transport properties of CNT modified cement mortars

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ABSTRACT

The beneficial effects of CNTs on the hydration process of CNTs filled cement composites and the hydration products, pore structures and transport of water in the composites has been recently reviewed [1]. It has been shown that the addition of CNTs is able to reduce the porosity of Portland cement paste, most notably by lowering the amount of mesopores and results in a denser microstructure due to the interactions between CNTs and hydration products of cement pastes [1]. The durability of cement-based materials strongly depends on their transport properties. Transport properties define the rate of ingress of deleterious species (e.g., water, chlorides, and sulfate) from the service environment into the cement-based structures and components throughout their service life [2]. Recent studies indicated that CNTs-reinforced cement-based composites exhibit improved transport properties relative to the conventional cement-based composites linked to the porous structure of the modified materials [2].

The scope of the current study is to provide an understanding of moisture transport in CNTs modified mortars after environmental loading in order to estimate their service life. For this purpose specimens are subjected into low freeze/thaw cycles according to ASTM C666. Temperature in low freeze is set at -18 ± 2 ºC and in thawing at +4 ± 2 °C. For the preparation of the nano-modified mortars, varying amounts of CNTs (0.1-1 wt % cement), surfactants and/or plasticizers are sonicated in aqueous suspensions and incorporated in cement and sand. For comparison purposes, specimens without CNTs are prepared. In order to define the effect of environmental loading, water absorption and gas permeability will be determined before and after freeze-thaw cycles. Water absorption will be estimated according to ASTM C1585 at three different temperatures as a function of CNT content and dispersion agent. Similarly gas permeability will be determined using a specially designed device which will allow the calculation of the gas loss through the open porosity of the mortar and thus the estimation of the gas permeability coefficient.

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References

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