Organic-Inorganic Hybrid Sol-gel Coatings to Prevent Corrosion of Galvanized Reinforcing Steel

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The use of hot dip galvanized steel (HDGS) has been recognized as one effective measure to increase the service life of reinforced concrete structures exposed to carbonation or to chlorides ions. Immediately after concreting, with the hydration of the fresh concrete, passivating surface layers made of calcium hydroxyzincate are formed, consuming between 5 and 10 µm of zinc. Simultaneous hydrogen evolution may also develop, leading to the loss of adherence between steel and concrete [1].

This work describes the studies developed for applying a sol-gel method to produce organic-inorganic hybrid (OIH) coatings over HDGS and evaluates their efficiency as a pretreatment to reduce the formation of excessive amounts of zinc oxides as well as H2 evolution. OIH matrices were synthesized by using a functionalized metal alkoxide as precursor (3-isocyanatopropyltriethoxysilane) that was made to react with five oligopolymers (Jeffamines) with different molecular weight in a 2:1 molar ratio. The inclusion of Cr(III) as corrosion inhibitor within the OIH coating was also tested [2-4]. All coatings were produced over HDGS samples by dip-coating method.

OIH coatings performance was evaluated by electrochemical and surface analysis techniques (SEM/EDS and GD-OES). For electrochemical studies, galvanic current and polarization resistance measurements were performed over a 70 days period in electrochemical cells specially designed to be embedded in cement based materials.

It was concluded that, when compared non-coated HDGS samples, all the OIH sol-gel coatings produced reduce the corrosion activity during the initial stages of contact of the HDGS with the high alkaline environment of the cement based materials studied. Furthermore, all the hybrid sol-gel coatings allowed the formation of calcium hydroxyzincate corrosion protective layers on the surface of the steel.

Keywords: Organic-inorganic Hybrids, Sol-gel, Galvanized Steel, Corrosion.

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Acknowledgements: The authors thanks the FCT for research the PhD grant SFRH/BD/62601/2009 and the financial support by Centro de Química [project F-COMP-01-0124-FEDER-022716 (ref. FCT Pest-C/Qui/UI0686/2011)-FEDER-COMPETE].