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Electrochemical evaluation of hot-dip galvanized steel (HDGS) coated with organic-inorganic hybrid materials in simulated concrete pore solutions

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Abstract. The unique properties and the wide application range of organic-inorganic hybrid (OIH) materials have attracted significant attention over the past decades, as the large variety of available chemical precursors allows the production of materials with tuned properties, with an enormous diversity of forms. For a long time, the corrosion protection of metallic substrates using coatings has been an active research area in materials science. As environmental and human health regulations are became more restrict is now required the design of alternative corrosion protection systems. This paper is a response to this challenge and describes the studies developed for applying a sol-gel method to produce an OIH coating on commercially available hot-dip galvanized steel (HDGS) with a Zn average thickness of 16 μm. The coatings efficiency were evaluate as corrosion protection layer when in contact with synthetic media simulating the aqueous solution existing in the concrete pores and short-term tests have been considered since these coatings should be effective since the first instants of contact between the rebar and the alkaline solution. The solutions were made by the addition of 0.2M KOH to a mother solution of saturated $Ca(OH)_2$. This paper describes the studies developed for applying a sol-gel method to produce OIH coatings on HDGS samples by dip-coating method and evaluates their electrochemical behavior as a corrosion protection layer when in contact with simulated concrete pore solutions. The ureasilicate matrices, U(X), were synthesized according to the literature [1] and were deposited on the HDGS substrate without residence time with one and three layers [2]. Coatings performance were evaluated by polarization resistance (R_p) and macrocell current density (i_{gal}) using an automatic data acquisition system [2]. The SEM/EDS analysis of the coatings before and after test was also performed. The coated samples showed enhanced corrosion resistance when compared to the uncoated ones.

[1] R. B. Figueira, C. J. R. Silva, E. V. Pereira, M. M. Salta, J. Electrochem. Soc., 2013, 160, C467-C479.
[2] R. M. Figueira, E. V. Pereira, C. J. R. Silva, M. M. Salta, Port. Electrochim. Acta, 31, 2013, 277-287.

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