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CORROSION PROTECTION OF CHROMIUM-COATED STEEL BY HYBRID SOL-GEL COATINGS

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The aim of this study was to investigate the effect of the amount of tetraethyl orthosilicate (TEOS) on the corrosion protection of chromium-coated steel (CCS) by poly(methyl methacrylate)-co-(trimethoxysilyl)propyl methacrylate (PMMA-co-TMSM) coatings in aerated and unstirred solutions containing 2wt% NaCl and acetic acid, at pH around 3.5. The MMA/Si molar ratios in the hybrid materials were adjusted to 10, 3, and 1 by adding different amounts of TEOS, producing materials denoted PMMA-Sil-10, PMMA-Sil-3, and PMMA-Sil-1, respectively. Scanning electron microscopy (SEM) images showed that the PMMA-Sil-10 and PMMA-Sil-3 hybrid coatings were homogeneous. These hybrids were submitted to 21 days of submersion in the same solution used to perform the electrochemical measurements, and their structural profiles investigated. ²⁹Si NMR results showed that hydrolysis and condensation reactions took place during the immersion treatment and provided further reinforcement of the siloxane network, which could enhance protection against corrosion. Furthermore the synthesis method enabled the close control of the inorganic phase content of the PMMA-RSiO_{3/2} hybrids. Electrochemical analysis demonstrated that the PMMA-Sil-3 coating remained on the metallic substrate for a prolonged period, providing high protection against corrosion due to the controlled TEOS content of the hybrid material.