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Structural and mechanical characterization of gamma-methacryloxypropyltrimethoxysilane (MPS) on Zn-electrocoated steel

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Abstract— Anaerobic adhesives have found an extensive use in many applications in mechanical engineering as sealers, threadlockers and retainers on metal surfaces. These adhesives have shown a good performance with threaded components with Cr[VI] coatings. Hexavalent chromium is a carcinogenic material so its use is limited or prohibited by environmental regulations in several countries, such as the United States and the European Union. In order to avoid this problem, non-chromated zinc coatings are used. However, anaerobic adhesives are not very effective with these types of coatings. Silane coupling agents could be an alternative to improve the performance of these coatings with anaerobic adhesives.

The aim of this work was to investigate the effect of a silane treatment on Zn-electrocoated steel. H1-NMR (proton nuclear magnetic resonance) studies of ?-methacryloxypropyltrimethoxysilane (MPS) hydrolysis provide the optimal conditions for silane application onto substrates. Analysis of silane layers over zinc coatings was performed by means of Fourier Transform Infrared (FT-IR) spectroscopy. In addition, single lap shear tests were used to compare the strength of anaerobic adhesive joints on Zn-coated specimens with different surface treatments. NMR shows that maximum hydrolysis of MPS takes place at 150 min. Adhesive joints prepared using MPS coatings after this hydrolysis time give maximum shear strength.

Index Terms— Silane, H1-NMR, anaerobic adhesives

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