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Abstract

A main objective of present research is to consider adhesive bonding as a novel maintenance and repairing damaged section trend for fluid transporting tubes. Nowadays, applying glass fiber reinforced epoxy composite patches (GFRECPs) is considered as an alternative rapid and affordable repair system instead of traditional techniques such as removing strained sections. The main problem with repairing metal pipes using GFRECPs is low strength of adhesion between GFRECPs and a steel substrate. To make adhesion strong enough, it is necessary to excite the intrinsic adhesion forces such as dipoles across the interface which consequently increases a bonding strength due to Van der Waals forces; but secondary forces activation depends on surface regulation levels. In fact, providing a surface with a suitable roughness and increased pureness without any polluters is a key parameter achieving a highly resistant GFRECPs-steel adhesion. To do so, samples were prepared using the SiC paper up to 100, 220, 500 and polished to investigate the effect of different roughness levels in the range of 90.77 ± 1.81 to 2.97 ± 0.05 nm. The surfaces, interface features and bonding strength were characterized applying the atomic force microscope (AFM), water contact angle measurements, FE-SEM, single lap shear (SLS) and T-peel (90°) tests. The results revealed that the highest adhesion strength could be achieved at the polished substrate.

Keywords: structural acrylics, steels, surface roughness, atomic force microscopy, adhesion by chemical bonding/ mechanical interlocking, Glass fiber epoxy based composite.