

Effect of environmental pre-conditioning on bond of FRP reinforcement to concrete

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Abstract: To determine how environment affects the bond behavior of FRP reinforcement for concrete, FRP rods were subjected to accelerated environmental pre-conditioning and several mechanical tests. Specially-made smooth and lugged FRP rods consisting of glass/vinylester, carbon/vinylester, and carbon/epoxy composites were evaluated. The primary means of comparison of the pre-conditioned materials was the direct pull-out test, although pertinent properties of rods such as short-beam apparent shear strength and longitudinal modulus of elasticity were also evaluated. The results reveal that pre-conditioning of FRP rods prior to casting degrades the FRP material itself, but does not necessarily degrade the bond behavior. In particular, the smooth rods, which had low bond strength to begin with, had little change in bond strength. On the other hand, the lugged rods, which were made susceptible to the environment by the machining of lugs, had significantly reduced bond strength due to degradation of the resin or the fiber/resin interface. Of the three types of aqueous environments evaluated, high temperature combined with an alkaline solution is the most aggressive to the FRP materials evaluated. Certain experiments highlighted the importance of the resin rich surface on environmental resistance.