Composite to Metal Fastener Interactions Investigated While Immersed in Seawater

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Marine renewable energy devices use tidal, ocean current or wave energy for power generation. These devices are fully or partially immersed in seawater during service. Advances in marine renewable energy designs are being made to incorporate modular composites and a variety of alloys. Composites of interest include carbon fiber reinforced polymer (CFRP) composites, glass fiber reinforced polymer (GFRP) composites and hybrid composites with both carbon and glass fiber types. In some cases, the composite joints are made with metallic fasteners. The geometry arrangement of the marine fasteners and composite interconnect causes occluded regions, that after some exposure time can allow crevice or pitting corrosion to initiate within the occluded region. To understand the performance of these fastened systems, a modified crevice former was used to investigate crevice corrosion for fastened samples immersed in seawater using two types of glass firber reinforced plastic, carbon fiber reinforced plastic and hybrid reinforced plastic composite plates. Several alloys were investigated: Class 8.8 carbon steel, Zn plated Class 8.8 carbon steel, Xylane coated Class 8.8, Class 8.8 with sacrificial cathodic protection, 316SS, 2507SS, AL6XN and Ti grade 2. Three exposure conditions were investigated: Immersed in seawater indoors, tidal tank with seawater and deployed at a Barge (south Florida intracoastal waterway). The composite plates deployed on the barge were coated with antifouling paint prior to assembling the samples. A number of washers coated with Xylane showed blister and breaks, but little corrosion products leached out. Corrosion was observed on Class 8.8, Zn plated Class 8.8 (but in some cases, not all Zn coating was consumed), and 316SS. The extent of corrosion and the corrosion form varied not just depending on the materials, but also on the exposure environment.

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