

Triple-action self-healing protective coatings

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A shape memory polymer (SMP) self-healing coating was prepared to protect the aluminum alloy 2024-T3 from corrosion by the incorporation of dual-function microspheres containing polycaprolactone and the corrosion inhibitor 8-hydroxyquinoline (8HQ). The self-healing properties of the coatings were investigated via scanning electron microscopy, electrochemical impedance spectroscopy, and scanning electrochemical microscopy following the application of different healing conditions. The results demonstrated that the coating possessed a triple-action self-healing ability enabled by the cooperation of the 8HQ inhibitor, the SMP coating matrix, and the melted microspheres. The coating released 8HQ in a pH-dependent fashion and immediately suppressed corrosion within the coating scratch (Action I). After heat treatment, the scratched coating exhibited excellent recovery of its anticorrosion performance, which was attributed to the simultaneous initiation of scratch closure by the shape memory effect of the coating matrix (Action II), sealing of the scratch by the melted microspheres (Action III), and the synergistic effect of corrosion inhibition by 8HQ.