

Influence of Fastener Coating on Corrosion Behavior of Thixomolded Magnesium

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Thixomolded AM60B magnesium (Mg) castings are an attractive pathway for lightweighting, structurally efficient vehicle architectures, but their implementation is limited by galvanic corrosion at mixed-material joints. This work identifies fastener systems with optimal galvanic compatibility for AM60B substrates under both neutral salt spray and cyclic automotive service conditions (GMW1872, Option 6, Exposure D/E). Zn-based plated steel fasteners (Zn-Ni, Sn-Zn, Zn-Magni 565) consistently produced the most severe Mg attack, including deep pitting and perforation, while Al-plated steel fasteners - especially Al-plated steel with Ni pre-strike and subsequent anodization or Cr³⁺ passivation - minimized Mg pit depth, mass loss and overall degradation. Electrochemical measurements confirmed the benefit of Al-based coatings via lower corrosion potential, suppressed cathodic currents, and higher impedance relative to Zn-based plating. These results deliver a robust fastener and coating down-select for mixed-material underbody assemblies and establish a foundation for durable Mg-intensive designs in future vehicles.