

Enabling Virtual Assessment of Galvanic Corrosion Risk in Mixed-Material Architectures

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The increased use of dissimilar metal alloys in lightweight, high-strength vehicular structures necessitates an improved understanding of galvanic compatibility between mixed-material couples. Traditional assessment methods, such as electrochemical measurements and OEM-specific accelerated corrosion exposure testing, are deemed time-consuming and often limit utility during rapid iterative design phases. Furthermore, standard galvanic tables often rely on a 1:1 anode-cathode area ratio, failing to account for the complex geometric realities of modern automotive assemblies. This presentation details the key outcomes of a collaborative industry project: the development and application of a standardized electrochemical database populated with a comprehensive library of experimentally acquired automotive materials. Utilizing robust measurement protocols. This dataset captures the "as-manufactured" polarization behavior of automotive alloys, coatings, and sealants under relevant environmental conditions.

We will demonstrate the integration of this database within a validated CAD and CAE environment, enabling engineers to assess galvanic risk in complex assemblies beyond the limitations of simple intersection standards. The results illustrate how using validated electrochemical inputs allows for the rapid identification of corrosion hotspots in complex multi-material assemblies, facilitating more informed material selection, protection strategies, and design decisions early in the vehicle development process.