Modelling atmospheric corrosion of ZnAlMg coated steels

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Hot-dip ZnAlMg coatings are known to provide a superior corrosion resistance compared to conventional hot-dip galvanized steel under many different environments. ZnAlMg are multiphase coatings and their better corrosion properties are explained by their sacrificial behavior but also by the barrier properties afforded by the formation of protective oxides. The phases reactivity during corrosion governs the nature of corrosion products that form at the coating surface. It is therefore important to understand how the nature and distribution of phases impact the coating corrosion behavior.

A numerical model simulating the influence of ZnAlMg coating microstructure and environmental parameters has been developed. The dynamic model takes into account the local pH changes during corrosion, and simulates the selective dissolution of phases resulting from the galvanic coupling inside the coating itself and between the coating coupled to steel as it is the case at a cut edge.

The results highlight the preferential dissolution of Zn2Mg phase in a large range of pH and also Al dissolution from Zn/Al/Zn2Mg ternary eutectic in alkaline pH conditions, allowing the formation of protective Al containing corrosion product at the coating surface.