Summary

Zinc and its alloys are commonly used for corrosion protection due to their ability to act as sacrificial anodes. However, they face a challenge in aggressive environments, as they do not form a spontaneously passivating oxide film like some other metals. This makes it difficult to prevent initial corrosion. To overcome this, various surface treatments, including the development of hydrotalcite (HT) conversion coatings, have been explored. These coatings are promising due to their eco-friendly nature and relatively low cost.

The focuses of this PhD research are on understanding the synthesis conditions that influence the structure and corrosion resistance of hydrotalcite coatings applied to zinc alloys coated steel substrates. First, this study focuses on examining the effectiveness of organic inhibitor like picolinoyl N4-phenylthiosemicarbazide (**HL**) in preventing the corrosion of zinc and various zinc-alloy coated steel substrates in sodium chloride solution. Moreover, the effect of HL on the cut-edge of zinc-based sacrificial coated steel is investigated. Based on the findings, a mechanism is proposed to explain corrosion inhibition by the **HL** compound in a chloride-rich environment. Second, the study explores the impact of Al^{3+}/Zn^{2+} ratios on the morphology, structure, and protective properties of ZnAl HT conversion films formed on electrogalvanized steel. It also examines how the alloying elements, Mg and Al, influence the "in situ" development of ZnAl HT films on various zinc-coated steel substrates. In the next stage, the study delves into the role of inhibitors such as cerium and **HL** in the anti-corrosion mechanism of HT films. It explores the effect of precursor solution pH on the growth behavior, microstructure, and corrosion protection performance of Ce-doped ZnAl HT layers on zinc alloys coated steel. Furthermore, the corrosion resistance of ZnAlCe HT coatings is enhanced through post-modification of the HT samples with an **HL** solution. Finally, this study investigates the active protective properties of hydrotalcite conversion layers on zinc coated steel substrates within an acrylic coating system. The impact of HT conversion films on the adhesion strength corrosion resistance and the self-healing properties of acrylic coating systems is investigated.