

## Visualizing and quantifying the influence of N-Mo synergy on corrosion resistance of stainless steel by dissolution-diffusion-deposition model

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**Abstract** The synergistic effect of N and Mo has been investigated for decades. The existing explanations for the mechanisms behind can be generally summarized into three categories: (a) optimizing the components of passive film, (b) mutual promotion between  $\text{NH}_3/\text{NH}_4^+$  and  $\text{MoO}_4^{2-}$ , (c) forming mixed nitride with high stability. Although N-Mo synergistic effect has been revealed and successfully applied to design commercial corrosion resistant alloys, the previous work mainly focused on an already formed passive film, thereby failing to touch the core of this phenomenon. This work proposed a “dissolution-diffusion-deposition” model, which quantified the complex passivation process on alloy surface, including the anodic dissolution of alloy, diffusion and hydrolysis of metallic cations, and nucleation and growth of passive film. Furthermore, this model was optimized by calibrating the ion concentration, calculating the equilibrium between  $\text{H}^+$  and  $\text{OH}^-$ , as well as calculating the formation amount of passive film components. Through modelling studies, we visualized and quantified how N-Mo synergy promoted passivation process. Results demonstrate that N-Mo synergy enhanced corrosion resistance by suppressing acidification of solution, increasing  $\text{Cr}_2\text{O}_3$  content and improving cation-selectivity of passive film. The mutual promotion between hydrolysis of  $\text{NH}_3$  and transpassive dissolution of Mo oxides played a critical role in improving corrosion resistance.

**Keywords** Corrosion resistance, N-Mo synergy, passive film, “dissolution-diffusion-deposition” model

### Reference

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