# Preparation and Performance of Active Protective Coatings with Corrosion Inhibitors Directly Loaded on Two-Dimensional Materials

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**Abstract** The addition of corrosion inhibitors to organic coatings for active protection has been a hot research topic. Typically, these inhibitors are encapsulated in micro- or nano-containers similar to drug capsules, allowing for either responsive or passive release. However, most containers serve only to load the inhibitors and do not contribute to the protective performance of the coating itself. inhibitors while simultaneously leveraging their inherent physical barrier properties, which is By utilizing two-dimensional materials as containers, it is possible to directly load corrosion anticipated to result in enhanced protective effects.

In this study, we directly loaded the corrosion inhibitor 8-hydroxyquinoline (8-HQ) onto graphene oxide (GO) to prepare GO@8HQ nanocomposite fillers. GO@8HQ was then added to the organic coating on the surface of AA2024. The coating with GO@8HQ showed no signs of corrosion after salt spray test. A molecular dynamics model was established to study the adsorption of 8-HQ and GO in aqueous solution. The loading and release of 8-HQ on GO can be regulated by pH through electrostatic adsorption. When corrosion occurred on the aluminum alloy substrate, the pH increased, prompting the responsive release of 8-HQ to inhibit corrosion. The results indicated that this method of using two-dimensional materials as nano-containers provided a simple and effective method for developing practical protective coatings.

**Keywords** 8-Hydroxyquinoline, Graphene oxide, Direct loading, Active corrosion protection, Sol-gel coating, Molecular dynamics simulation

## Reference

[1] D. Shchukin, H. Möhwald, A Coat of Many Functions, Science 341 (2013) 1458–1459. https://doi.org/10.1126/science.1242895.

[2] S. Ren, F. Meng, X. Li, Y. Cui, R. Liu, Y. Liu, X. Hu, L. Liu, F. Wang, A self-healing epoxy composite coating based on pH-responsive PCN-222 smart containers for long-term anticorrosion of aluminum alloy, Corros. Sci. 221 (2023) 111318. https://doi.org/10.1016/j.corsci.2023.111318.

[3] Y. Wang, J. Wang, L. Huang, X. Ding, Z. Chen, C. Ren, W. Hao, L. Ma, D. Zhang, Photothermally activated self-healing coatings for corrosion protection: A review, Prog. Org. Coat. 185 (2023) 107886. https://doi.org/10.1016/j.porgcoat.2023.107886.

[4] M. Yu, H. Dong, H. Shi, L. Xiong, C. He, J. Liu, S. Li, Effects of graphene oxide-filled sol-gel sealing on the corrosion resistance and paint adhesion of anodized aluminum, Appl. Surf. Sci. 479 (2019) 105–113. https://doi.org/10.1016/j.apsusc.2019.02.005.