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# A review of surfactants as corrosion inhibitors and associated modeling

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ABSTRACT

Surfactants have been commonly used as corrosion inhibitors for the protection of metallic materials against corrosion. The amphiphilic nature of surfactant molecules creates an affinity for adsorption at interfaces such as metal/metal oxide–water interface. The adsorption of surfactant on metals and metal oxides creates a barrier that can inhibit corrosion. The properties of surfactant and the interaction of surfactant with metal or metal oxide and the surrounding solution environments determine the level of adsorption and corrosion inhibition. Understanding and modeling the behavior of surfactants in corrosive environments is critical to optimal utilization of surfactants as corrosion inhibitors. This review of surfactants as corrosion inhibitors is designed to provide systemic evaluation of various physical and chemical properties of surfactants, surfactant behaviors in corrosive environments, and their influence in corrosion inhibition, which can be used to improve the effectiveness with which surfactants are used as corrosion inhibitors in a variety of environments. Progress in the development of various predictive models, including semi-empirical models, mechanistic models, and multiphysics models, are reviewed for the evaluation and prediction of surfactant properties and surfactant corrosion inhibition efficiency. Applications of these models to experimental design and analysis, surfactant design and selection, and lifetime prediction are also discussed.



**Contents**



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**Nomenclature**

| | |
|---|---|
| AFM | atomic force microscopy |
| AMT | alternative molecular thermodynamic |
| BAC | benzalkonium chlorides |
| CFU | colony forming unit |
| cmc | critical micelle concentration |
| CVD | chemical vapor deposition |
| DDPB | dodecylpyridinium bromide |
| DFT | density functional theory |
| EDL | electrical double layer |
| FTIR/IRS | Fourier Transform Infrared internal reflection spectroscopy |
| GDP | gross domestic product |
| ICI | integrated corrosion inhibition |
| IHP | Inner Helmhotz plane |
| KV | Koroleva and Victorov |
| LA | Langmuir adsorption |
| LB | Langmuir-Blodgett |
| MF | Moreira and Firoozabadi |
| MI | multi-interaction |
| MLA | modified Langmuir adsorption |