



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.

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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 Helmholtz plane
KV	Koroleva and Victorov
LA	Langmuir adsorption
LB	Langmuir-Blodgett
MF	Moreira and Firoozabadi
MI	multi-interaction
MLA	modified Langmuir adsorption

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