Research Progress on Performance Analysis and Development Methods of Vapor Phase Corrosion Inhibitors

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Abstract Vapor Phase Corrosion Inhibitors (VPCIs), as an important technology for mitigating atmospheric corrosion, have been increasingly applied in complex and harsh marine atmospheric environments. Vapor phase corrosion inhibitors can continuously volatilize molecules or groups in confined or semi-confined spaces. Owing to their gas permeability and non-interference with the protected objects, they are frequently utilized to prevent atmospheric corrosion of metal components and precision instruments. This review commences with the action mechanism and classification of vapor phase corrosion inhibitors, elaborates on performance analysis methods that include volatility test, corrosion mass-loss test, electrochemical test, adsorption and thermodynamic analysis and microscopic analysis which are applied and improved in researches of corrosion inhibitors. Additionally, it introduces computational simulation techniques for structure-activity relationship. Furthermore, this review discusses the environmental factors affecting the efficacy of vapor phase corrosion inhibitors that include marine salt spray environment, high humidity, alternating temperature and ultraviolet radiation. Finally, this review summarizes research on the synergistic effects, formulation, and molecular modification of vapor phase corrosion inhibitors both domestically and internationally, and aims to encourage a wider use and development of vapor phase corrosion inhibitors by providing further insights into future research in this field.

Keywords vapor phase corrosion inhibitors; performance analysis; synergistic effects; development