Prediction of Atmospheric Corrosion of Carbon Steel Using the Conventional Methods and the Applicability of Machine Learning

Le Thi Hong Lien and Nguyen Thi Thanh Nga
Institute of Material Science, Vietnam Academy of Science and Technology, Hanoi, Vietnam
honglien@ims.vast.ac.vn

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Atmospheric corrosion on metallic materials is very common and it causes a big amount of economic loss every year. Thus, it is meaningful to predict the corrosion loss of metals in different field environments.

Atmospheric corrosion process is very complicated and non-linear which is influenced by multiple factors such as temperature, relative humidity, solar radiation, precipitation, wind, pollutants, and so on. These environmental factors are non-constant and change continuously over time. Meanwhile the empirical corrosion effect models are mostly linear or generalized linear relations, which cannot describe the complex comprehensive nonlinear effects of the actual environment. The prediction performance of the corrosion models is also limited due to few input parameters and the scatter of the data. In addition, most of these models are of limited applicability as they are only valid for specific local geographical conditions, as the local geographical condition changed, such corrosion models are no longer applicable.

Besides, most of the traditional empirical models were built based on the exposure test data using conventional regression methods which is limited in dealing with nonlinear interactive effects.

In recent years, with the development of machine-learning algorithms, many studies have used ML technology to establish the corrosion models to implement the prediction of the corrosion status. In this paper, the atmospheric corrosion models of carbon steel developed using conventional method and machine learning (ML) approach are reviewed. The ML are also applied to predict the atmospheric corrosion of carbon steel based on the data of the international cooperative exposure programs and the exposure test data of Vietnam. The preliminary results promise the high potential of using ML algorithms to predict the atmospheric corrosion of carbon steel with better fitness in comparison to using the conventional methods.