High-throughput experiments for weathering steel surface treatment

Lingwei Ma, Zongbao Li, Chenhao Ren, Jinke Wang, Dawei Zhang

National Materials Corrosion and Protection Data Center, University of Science and Technology Beijing, Beijing 100083, PR China

Abstract： High-throughput experimental techniques can accelerate and economize corrosion evaluation, and thus, have great potential in the development of new materials for corrosion protection such as corrosion-resistant metals, corrosion inhibitors, and anticorrosion coatings. In this work, a novel high-throughput screening method of the stabilization treatment agents for promoting the growth of rust layers on weathering steel surface is developed by depositing microarrays of droplets containing different stabilizer solutions on a Q420 MPa low-alloy weathering steel. This method can test up to 200 channels of stabilizer solutions with a miniaturized setup. In addition, the method allows the independent control of droplet compositions and concentrations. Different combinations and concentrations of Na_2WO_4, Na_2MoO_4, and $NaNO_2$ were dropped on the steel surface, and the growth behavior of the rust layer and the corrosion resistant property were assessed using the wire beam electrode (WBE) technology and surface observations. The combination of 0.6 g/L Na_2WO_4 and 1.2 g/L Na_2MoO_4 could promote the generation of a dense rust layer with a high percentage of α-FeOOH, which is conductive to strengthen the corrosion resistant property of the rust layer. WBE electrochemical results demonstrate the highest impedance modulus among all the stabilizer combinations.

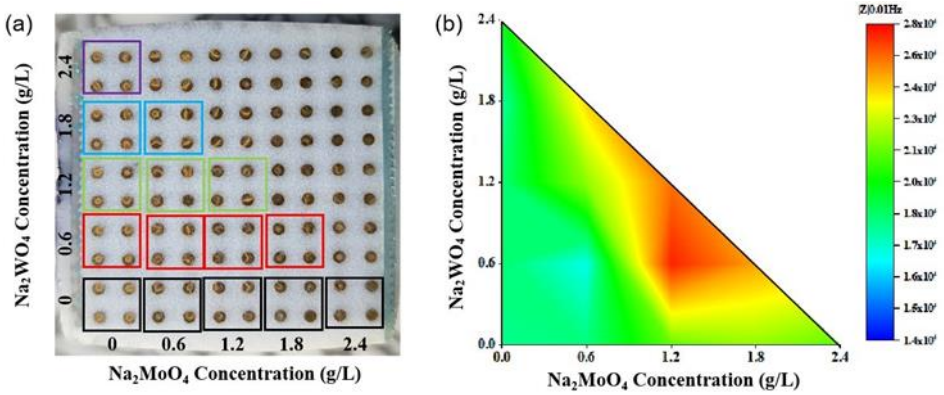

Figure. (a) Photograph of rust layers on Q420 weathering steel with Na_2WO_4 and Na_2MoO_4 addition; (b) 0.01 Hz impedance modulus measured on each wire beam electrode.