Screening study of corrosion inhibitor for the surface anti-corrosion of the Yuquan Iron Pagoda

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Abstract:

The Yuquan Iron Pagoda is one of the famous ancient buildings in China, the corrosion of its surface has always been an important topic in the protection of cultural relics. In order to effectively delay the corrosion of the Pagoda and ensure its long-term stability, this study aims to screen out the corrosion inhibitor suitable for the surface anti-corrosion of the Pagoda. In the article, chemical testing methods such as weightlessness experiment, scanning electron microscope-energy spectroscopy, and laser Raman instrument were used to analyze the characteristics of different cast iron specimens before and after corrosion inhibition, such as film-forming morphology, thickness, and composition, after being immersed in 3.5% (*wt*.%) NaCl solution for 168 h. Additionally, the corrosion resistance of cast iron specimens before and after corrosion inhibition was tested by combining electrochemical polarization curves and impedance analysis. The results showed that 4# corrosion inhibitor had the highest corrosion inhibition efficiency (94.64%). It could react with the iron matrix to form a stable five-membered cyclo-chelate (average film thickness was 51.92 μm), and the film-forming material was adsorbed on the surface of the cast iron specimen in the form of cluster flocculent to stop the corrosion of cast iron. The magnitude of the dimensional passivation current of the cast iron specimens with 4# corrosion inhibitor added was reduced by about 3 orders of magnitude compared to that of the blank samples, and the corrosion resistance was significantly improved. The modal value of Z after 4# corrosion inhibitor pre-filming was much higher than that of the blank specimen and other corrosion inhibition systems both at the low-frequency end and the high-frequency end. Furthermore, the Rp value of 4# corrosion inhibitor in the electrochemical impedance fitting circuit diagram was the largest (Rp=180600), which further indicated that the corrosion reaction of the cast iron specimen with the addition

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of the 4# corrosion inhibitor was more difficult to carry out. Therefore, the corrosion inhibition of 4# corrosion inhibitor had the optimal effect. Through a series of experiments, this paper analyzes the protective effect of different corrosion inhibitors against corrosion on the surface of the simulated cast iron specimen of the Pagoda, which provides a scientific basis for the protection of the Yuquan Iron Pagoda.

Keywords: The Yuquan Iron Pagoda; Heritage conservation; Screening; Corrosion inhibitors against corrosion; Chemical and electrochemical analyses.