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Surface analysis of 2-mercapto-1-methylimidazole adsorbed on copper by X-ray photoelectron spectroscopy

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Abstract

A detailed analysis using X-ray photoelectron spectroscopy (XPS) is presented for the system of 2-mercapto-1-methylimidazole (MMeI) adsorbed on Cu in 3 wt.% NaCl solution. High-resolution and survey XPS spectra and XPS-excited Auger $L_3M_{4,5}M_{4,5}$ spectra were analysed in detail. Surface analysis revealed that the MMeI molecules do not lie flat on the surface via π -d interactions, but adsorb on the surface through an N-S-bridge configuration. Moreover, the characteristic Cu(I)-MMeI connection fingerprint, which is usually observed for these kinds of molecules, was not observed. Tougaard thickness analysis showed that a relatively thin MMeI surface layer (0.3–0.6 nm) is formed on the Cu substrate after 1 h of immersion. Herein, MMeI is considered as a Cu corrosion inhibitor for chloride solution for short-term immersion periods. Based on the XPS analysis, an explanation of why MMeI is not effective for longer-term immersion periods, compared with similar compounds, is given.

Keywords: surface analysis; X-ray photoelectron spectroscopy; 2-mercapto-1-methylimidazole; copper

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