Microscopic Investigations Towards the Practical Implementation of Film Forming Amines as Corrosion Inhibitors in High-Temperature Aqueous Systems

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This presentation will focus on fundamental studies that are essential for the practical implementation of film-forming amines as corrosion inhibitors in high-temperature aqueous environments, such as the water-steam cycles of steam generators and steam power plants. Our research addresses the structure of the protective films and the reactions of amines in high-temperature water and steam, which are the two major aspects necessary to bridge the gap between fundamental knowledge and industrial applications.

For the first aspect, we investigate the molecular-level processes involved in the formation of corrosion protective films by oleylpropanediamine (OLDA) on copper surfaces at 150 °C [1]. Using quantitative NMR and surface characterization methods, we unravel molecular arrangements and coordination complexes, laying the groundwork for a deeper understanding of the corrosion protection mechanisms. The non-uniform film thickness and water repellency are discussed, shedding light on the mechanisms of film formation.

To understand the second aspect, we studied the hydrothermal reactions of ethyl- and octylamine as model species representing the key molecular structure of film-forming amines. Using NMR spectroscopy, we reveal the reaction pathways at subcritical and supercritical temperatures [2, 3]. Based on the accelerated reactions at low pH we have found, we establish the key reaction schemes necessary to understand the behavior of film-forming amines under high-temperature conditions.

By elucidating the fundamental principles underlying the protective film formation and decomposition reactions, this presentation aims to contribute to the knowledge necessary for the eventual practical implementation of film-forming amines as corrosion inhibitors in high-temperature aqueous environments.

References

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