Versatile Applications of Scanning Electrochemical Microscopy: From Localized Corrosion Analysis to Electrocatalysis in Metals and Alloys

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Scanning Electrochemical Microscopy (SECM) has established itself as a fundamental and versatile technique in surface electrochemistry, with extensive applications in corrosion science and electrocatalysis. Its capacity for spatially and chemically resolved measurements enables precise investigation of localized electrochemical phenomena, such as redox reactions, inhibitor efficacy, and ion transport within protective coatings [1-5].

When combined with structural characterization methods such as Electron Backscatter Diffraction (EBSD) and Energy Dispersive X-ray Spectroscopy (EDX), SECM yields comprehensive mechanistic insights into the influence of microstructural features on material degradation. In electrocatalysis, SECM facilitates the evaluation of hydrogen evolution (HER) [6], oxygen evolution (OER) [7], and oxygen reduction reactions (ORR) [8] at the level of individual grains, specific crystallographic facets, or even single nanoparticles. It also complements techniques such as Scanning Electrochemical Cell Microscopy (SECCM) by offering broader spatial coverage and enabling performance mapping across complex surfaces. With its comprehensive capabilities, SECM serves as an indispensable tool for elucidating surface reactivity and guiding the rational design of robust, high-efficiency materials.

References

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