Statistical analysis of metastable pitting behavior of 2024 aluminum alloy based on deep learning

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Abstract During the initiation and development of pitting in aluminum alloy, numerous widely dispersed and irregularly shaped pits emerge. Rapid progress in computer vision technology, particularly in image processing, has considerably facilitated the collection and analysis of image data, presenting novel solutions to these challenges. In this study, a processing flow model for recognizing, statistically analyzing, and assessing pitting images in 2024 aluminum alloy was established based on deep learning object detection algorithms. By analyzing the statistical outcomes, the process of pitting development can be intuitively distinguished. Furthermore, the critical size for the transition from metastable pitting to stable pitting in aluminum alloy was accurately determined. In addition, by combining X-ray computed tomography testing, the evolution of pitting in aluminum alloys and its correlation with microstructure were delineated. Integrating deep learning into analysis provides valuable insights into the behavior and mechanisms of metastable pitting.

Keywords Deep learning; Object detection algorithm; Aluminum alloy; Metastable pitting; Statistical analysis

Reference

[1] Z. Xu, B. Cai, L. Yan, X. Pang, K. Gao, Statistical analysis of metastable pitting behavior of 2024 aluminum alloy based on deep learning, Corrosion Science, 233 (2024) 112077. https://doi.org/10.1016/j.corsci.2024.112077.

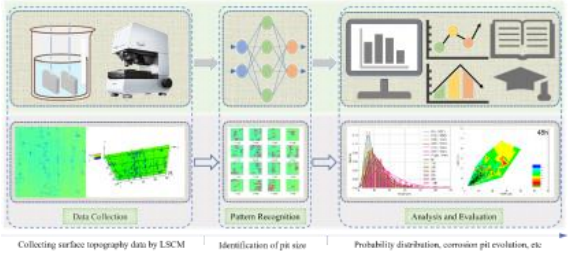

Fig. 1. Schematic diagram of aluminum alloy pitting recognition model.