Microstructural evolution in 316L stainless steel under lead-bismuth eutectic corrosion

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Lead-bismuth eutectic (LBE) is a highly effective and corrosive liquid metal coolant, suitable for various high-temperature cooling applications. Previous study has shown that deformation-induced twin boundaries can facilitate LBE penetration into steel, accompanied by the ferritization process that transforms the face-centered cubic (FCC) steel matrix into a body-centered cubic (BCC) structure. Despite these findings, the mechanism underlying ferritization in 316L stainless steel in contact with oxygen-poor LBE remains not fully understood. In this study, we utilized an advanced technique known as four-dimensional scanning transmission electron microscopy (4D-STEM) to investigate ferritization during late-stage LBE corrosion. Our analysis revealed that the ferritization mechanism in late-stage corrosion differs from that in early-stage corrosion. This study provides valuable insights into the microstructural evolution of LBE corrosion at different stages, enhancing our understanding of the mechanisms driving static LBE corrosion in 316L stainless steel.