Effect of grain boundary engineering on corrosion behavior of 316LN austenitic stainless steel in liquid lead-bismuth eutectic at 550℃

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Abstract

The environmental compatibility of materials is the key to the development and construction of lead-cooled fast reactors (LFRs). Nowadays, austenitic stainless steels (AuSS 316L, 316Ti) and ferritic/martensitic (F/M) steels (T91, HT9) are conditionally suitable for LFRs [1,2]. In the present work, 316LN Auss with different fraction of low-Σcoincidence site lattice boundaries and grain size were obtained by grain boundary engineering (GBE) treatment. The effects of GBE on corrosion behavior of 316LN austenitic stainless steel in liquid oxygen-saturated and oxygen-controlled (10^{-6} wt.%) LBE at 550℃ for 200-1000h were investigated. Grain refinement with high proportion of low-Σcoincidence site lattice boundaries improved the corrosion resistance of 316LN Auss in liquid LBE. It was found that the preferential intergranular oxidation (PIO) mainly along random high angle boundaries (RHGBs) with GB migration, while the low-Σ coincidence site lattice boundaries were much more resistant to intergranular oxidation. The grain size and GB type involved corrosion mechanism for 316LN Auss in liquid LBE is discussed.

Keywords: Austenitic stainless steel, LBE corrosion, Grain coundary, Preferential intergranular oxidation,Grain boundary migration

Reference

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