Effect of the Ni/Co ratio on the structural and initial oxidation properties of NiCo-based superalloys revealed by *in situ* microscopy

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Abstract Oxidation is one of the main failure modes of superalloys, and the initial oxidation of a superalloy provides clues for its failure analysis. NiCo-based superalloys exhibit superior mechanical properties, but their oxidation behaviour is still debatable, especially in terms of the ratio of Ni/Co. Here, we show the effect of the Ni/Co ratio on the initial oxidation behaviour at the nanoscale by in situ environmental transmission electron microscopy (ETEM), which provides the initial microstructural changes in the γ/γ′ structure-based alloy. The results indicate that Ni-rich alloys exhibit better structural stability at high temperatures than Ni-deficient alloys. A high content of Ni promotes the formation of a dense oxide layer, inhibits the oxidation rate, and improves the oxidation resistance. This result will help to elucidate the basic process of oxide formation in NiCo-based single-crystal superalloys and provide ideas for improving their oxidation resistance for alloy design.

Keywords: NiCo-based superalloys; γ/γ′ structure; in situ oxidation; ETEM; Ni/Co ratio