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Influence of Ruthenium on Microstructural Evolution in a Model Co-Al-W Superalloy

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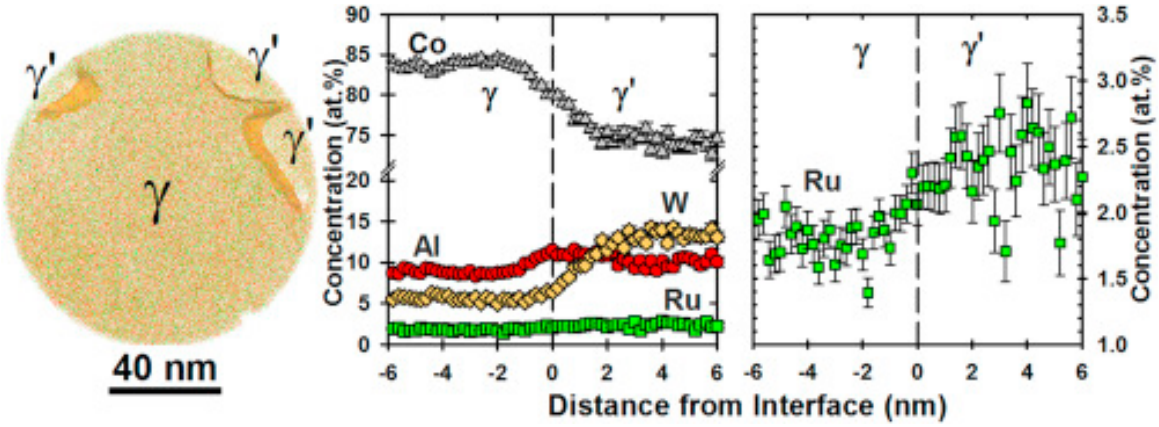

Caption: *Elemental γ/γ' partitioning of a Co-9.4Al-7.5W-2.1Ru at.% after 16 h of aging at 900 °C: (a) top-view cross-section of APT reconstruction consisting of 9 million atoms collected and containing three partial γ'-precipitates described by a 9 at.% W isoconcentration surface. (b) Proximity histogram, averaged among the three partial γ'-precipitates, of the constituent elements where the zero value (0) of the interface is defined as the inflection point of the majority species, Co. (c) Higher resolution portion of Ru proximity histogram. The dashed horizontal line represents the bulk Ru concentration of 2.1 at.%.*

Scientific Achievement

The effect of a Ru addition on ternary Co-Al-W superalloys was investigated for the first time. In contrast to conventional Ni-based superalloys, where Ru partitions to the γ-matrix, in Co based superalloys, Ru partitions to the γ'-precipitates. Moreover, Ru does not affect the γ' strengthening phase fraction. However, a Ru addition leads to a discontinuous phase transformation, initiated at grain boundaries, where γ- and γ'-phases transform into a lamellar phase mixture containing Co_3W ($D0_{19}$), a fcc solid-solution (γ), and Co(Al,W) (B2).

Significance

In Ni based superalloys, a Ru addition has been investigated as a replacement to more expensive Re to enhance the high-temperature mechanical properties of the alloys. This article examines the viability of using Ru to enhance the microstructure and mechanical properties in Co based superalloy.

Citation

Daniel J. Sauza, Peter J. Bocchini, David C. Dunand, David N. Seidman, Influence of ruthenium on microstructural evolution in a model Co-Al-W superalloy, Acta Materialia, Volume 117, 15 September 2016, Pages 135-145, ISSN 1359-6454, http://dx.doi.org/10.1016/j.actamat.2016.07.014.