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Influence of alloying elements on high-temperature structure and microstructure of Co-Re base alloys

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Co-Re-based alloys [1] are being developed to supplement single crystal Ni-based superalloys in future gas turbines. Higher operation temperatures are foreseen for them enabling a higher efficiency of energy conversion and thus lower fuel consumption. Alloying elements with various functionality are added to these alloys, for example Re to increase melting temperature, Cr or Ni for oxidation resistance, C and Ta to produce high-temperature strengthening phase (TaC), or boron to improve ductility [2]. We report in situ neutron scattering investigations at elevated temperatures of B, Ta and Ni addition effects on structure and microstructure. First, boron influence [3,4] on stability of the matrix at the foreseen metal operation temperatures (≥1200℃), then optimum ratio of Ta and C for improved strengthening [5], and, finally, influence of Ni on hcp –fcc transformation [6] temperature and sigma phase content [7]. TaC were found to be a suitable high-temperature strengthening phase up to 1200℃. Neutron scattering proved that boron addition is not detrimental for high-temperature stability of the matrix.

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