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Structural characterization of high temperature VDM-780 Ni-based superalloy by means of Neutron scattering and transmission electron microscopy

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Ni-based superalloys based on the □/□'system are widely used for high temperature applications, as parts for jet engines, due to their good mechanical properties at high temperatures. In these materials, the austenitic matrix (□) is strengthened by intermetallic precipitates of Ni3Al (□') and Ni3Nb (□") and it has been also observed the existence of co-precipitates of both phases with different morphologies (plate, needle, cube or disc shape). Other phases that can also be formed are Ni3Nb-based (□) and Ni3Ti- based (□). The existence of the different phases and the quantity and shape of the different precipitates and co-precipitates depend on composition, heat treatment and processing conditions. Especially, it is crucial to control the evolution of the different phases at high temperature in order to tailor the mechanical properties at high temperatures.
In this work we present the structural studies on VDM-780 superalloy. By means of neutron diffraction (ND) we have determined the different phases present in this material after three different aging conditions performed for setting up different microstructures. Apart from the □ matrix, the presence of the □'and a high temperature phase have been observed and the amount depends on aging treatment, but no traces of □"phase has been found. The high temperature phase is compatible with both □ and □ phases but diffraction patterns do not allow to distinguish between the orthorhombic □ phase and the hexagonal □ phase. Both phases are usually present at the grain boundaries and the correct identification of them is crucial for the high temperature applications, as a small amount of □ phase is essential for a good workability of the alloy.
In addition, high resolution transmission electron microscopy (HRTEM) study of the high temperature precipitates have allowed to identify both □ and □ phases in the high temperature precipitates and first results are shown in this work.

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