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Structure investigation of the new VDM Ni-based superalloy 780 Premium

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Ni-based superalloys are used for high temperature (T) applications that require good mechanical properties. Among these alloy 718 is the most widely used with operation T up to 650 ℃. In this alloy the austenitic matrix is strengthened by γ'-Ni3Al and γ"-Ni3Nb precipitates. Other phases that can be formed are δ-Ni3Nb and η-Ni3Ti. The existence of the different phases, quantity and shape of the precipitates depend on composition, heat treatment and processing conditions. It is crucial to control their evolution at high T in order to tailor the mechanical properties. The aim of increasing the operation T forces the development of materials stable at higher T. Waspaloy has higher amount of γ' phase which allows its use at higher T but has a poor hot formability. The alloy 718Plus improves the performance at high T and it is expected easier processing. With improved composition new VDM alloy 780 Premium has been developed for higher service T and its structure and performance is under investigation.
This work presents the in-situ structural characterization of the new VDM alloy 780 Premium after three different aging conditions by means of neutron and X-ray diffraction at room T and elevated T. The morphology of the different phases is studied by scanning electron microscopy and small angle neutron scattering. Furthermore, the solvus T of the different phases is determined and the structural properties correlated with hardening of the materials.

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