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In-situ characterization at high temperature of VDM alloy 780 Premium

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Ni-based superalloys are used for high temperature (T) applications that require good mechanical properties, as gas turbines. Among these alloy 718 is the most widely used with operation T up to 650 °C. In this alloy the austenitic matrix is strengthened by γ' and γ'' precipitates. Other phases that can be formed are δ and η . 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 with 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, with higher amount of γ' , can be used at higher T but has a poor hot formability, while for the alloy 718Plus it is expected to have easier processing.

A new alloy called VDM 780 Premium, with good formability and the potential for high operation T, was selected for this investigation due to its direct industrial application. Measurements were performed on this alloy to determine its structure after different aging conditions. In-situ neutron diffraction (ND) and small-angle neutron scattering (SANS) experiments were carried out up to the dissolution temperature of all precipitates. We studied the amount of the phases present in the material and their stability with temperature as well as the evolution of cell parameters, grain sizes and morphologies as function of temperature.

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