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# In situ precipitation of CoRe alloys studied via neutron and synchrotron methods

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In the field of gas turbines, the goal of high-temperature alloy development is to reach higher service temperatures including lowering the consumption of the fuel, making the energy production/transformation more efficient and more economical. Our efforts in this area was to develop a new cobalt rhenium (CoRe) base superalloy. Various techniques such as neutron, electron and X-ray based methods are applied to study the microstructure under various environments of temperature and external forces.
High-temperature CoRe based alloys were developed for applications up to 1200°C. The strengthening is performed with a dispersion of nanosized tantalum carbide (TaC) precipitates. The cooling rate from the supersolution stage has strong influence on the size and volume fraction of the precipitates. Various cooling rates and the influence of Cr addition in the alloy were studied mainly with wide-angle and small-angle neutron scattering to monitor in situ the TaC precipitate behaviour under such external parameters.
The isochronal cooling processes are described with the Kampmann–Wagner's numerical (KWN) model. The in-situ measurements give the unique possibility to calibrate the model parameters, whereas the ex situ measurements are used to assess the model predictions.

Reference:
1.) L. Karge, R. Gilles, D. Mukherji, D. Honecker, P. Beran, P. Strunz, M. Hofmann, N. Schell, J. Rösler, S. Busch, Advanced Engineering Materials (2021), 2100129.

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