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In situ neutron dilatometry investigation of βo→β phase transformation in TiAl alloys

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Intermetallic TiAl alloys represent a novel class of lightweight high temperature materials for applications in aero and automobile industries. One of their most impressive example of use is replacing the twice as dense Ni-based turbine blades in the last stages of the aero engine in the Airbus A320neo family, yielding to a decrease of noise and CO2 emission.
Nevertheless, there is need for improvements e.g. in processing for higher cost effectivity and better material behavior at the working temperatures. Advanced TiAl alloys are particularly well suited for hot working due to the presence of the ductile, disordered, body-centered cubic (bcc) β phase (A2 structure) at high temperatures. However the challenge to be met is to avoid presence of the so-called "ordered beta"βo phase (B2 structure), which is brittle at service temperature and decreases the turbine blades lifetime.
Our current project is a fundamental investigation of βo→β phase transformation in TiAl and its dependency from different β-stabilizing elements. We used the new dilatometer DIL 805AD as an in situ sample environment at STRESS-SPEC (FRM II, Garching bei München) for stepwise heating experiments in the temperature range from 1000℃ up to 1400℃. The results unambiguously determined the presence of the βo phase and the transformation temperatures of βo→β. The results will be compared with synchrotron measurements performed with the same type of dilatometer under a better time resolution.

Authors: KONONIKHINA, Victoria (Helmholtz-Zentrum Geesthacht); Dr STARK, Andreas (HZG); LI, Xiaohu; GAN, Weimin (Helmholtz-Zentrum Geesthacht); SCHREYER, Andreas (Helmholtz-Zentrum Geesthacht); Prof. PYCZAK, Florian (HZG)

Presenter: KONONIKHINA, Victoria (Helmholtz-Zentrum Geesthacht)

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