ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Achieving stress-induced martensitic transformation in metastable beta-Ti alloys with high oxygen content

Dalibor Preisler[a], Jiří Kozlík[a], Michal Knapek[a], Petr Harcuba[a], Kristián Šalata[a], Mariano Casas[a], Josef Stráský[a]

[a]*Charles University, Faculty of Mathematics and Physics, Department of Physics of Materials, Ke Karlovu 5, Prague 2, Czech Republic*

[a]*preisler.dalibor@karlov.mff.cuni.cz*

Martensitic phase transformations occurring during loading of materials yield some very interesting effects, e.g. transformation-induced plasticity (TRIP) or shape memory effect. In metastable beta-Ti alloys, simultaneous activation of several deformation mechanisms (dislocation slip, TRIP) leads to enhanced ductility. Moreover, oxygen was proven to provide a very significant strengthening, content of 0.7 wt% of oxygen can lead to a yield strength of over 1000 MPa, more than double when compared to oxygen-free alloy. Thanks to work-hardening, the material is still ductile when in pure beta phase condition. In the present work, we studied the combined effect of high oxygen content and simultaneous stress-induced martensite for potential improvement in ductility by TRIP. First, the testing was done on spark plasma sintered gradient high-throughput Ti-Nb-Zr-O samples. After loading of these samples, several compositions showing martensitic transformation in SEM and XRD were prepared in the conventional way by casting and thermomechanical treatment. Thorough analysis including tensile testing and SEM / XRD analysis of structures after deformation was conducted.

Keywords: Ti alloys, stress-induced martensite, interstitial strengthening, phase stability, ductility