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Investigation of thermomechanical properties during biaxial loading of βTi alloy named Gum Metal that combines high strength to high elastic properties

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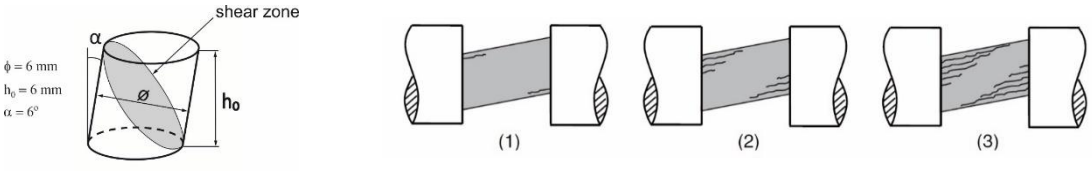
Multifunctional β-Ti alloy named Gum Metal, characterized by the unique performance for biomedical applications, i.e. low Young's modulus, similar to bone, large nonlinear recoverable deformation, high strength and biocompatibility [1] was subjected to biaxial compression/shear loadings [2, 3]. An MTS testing machine was used to measure the quasi-static, whereas a Split Hopkinson Pressure Bar (SHPB) system allowed to obtain higher strain rates. Cylindrical samples of 6 x 6 mm with an inclination of 6° were used (Fig. 1a, 1b).



a) b)

Fig. 1. a) Sample geometry. b) Stages of development of the multiaxial compressive-shear stress field

Fig. 2a presents the images of samples after the quasi-static and dynamic test. It is seen that the samples during quasi-static testing underwent heavy plastic deformation, nevertheless, no cracks are visible. Samples after dynamic tests are characterized by lower plastic deformation, i.e. smaller sample shortening and distinct cracks, or even destruction. Highly deformed grains, elongated perpendicular to the deformation direction after dynamic testing are clearly visible by using LM and SEM techniques (Fig. 2b). The temperature of the sample was measured in contactless manner by using a fast and sensitive *ThermaCam Phoenix* IR camera.

a) b)

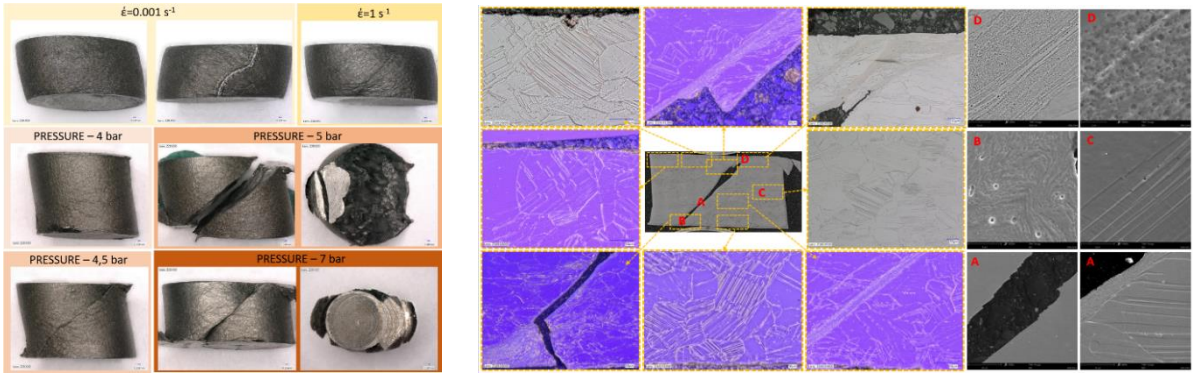


Fig. 2. a) Gum Metal samples after quasi-static and dynamic testing b) Microstructure of Gum Metal after dynamic testing: Stitched image showing the entire cross-section of the sample. Light micrographs (LM) in yellow frames together with a indication on stitched image, SEM images with higher magnification along with letter description

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