Analysis of elastic-plastic properties of Gum Metal - Ti β alloy - subjected to loading in quasi-static and dynamic strain rates range by using field optical methods

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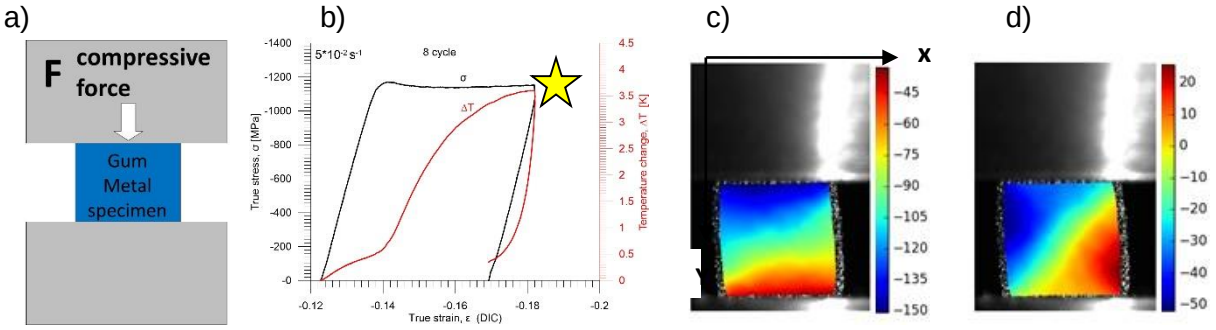
At the turn of the century, a unique material appeared in the world - the Ti alloy that combines high metal strength with high elasticity of the rubber. The alloy, named Gum Metal, developed in Toyota Center & Development Labs was introduced in *Science* (2003). It is characterized by a low, bone-like value of the Young's modulus (≈ 60 GPa), a large range of reversible deformation (≈ 2.5%), high strength (> 1000 MPa) and high biocompatibility. Such properties create great application possibilities in biomedical, rehabilitation and sports equipment, as well as automotive and aerospace industry.

The aim of the proposed project is to conduct experimental studies and modeling of the impact of strain rate on the elastic-plastic properties of Gum Metal subjected to compression in wide range of strain rates, including dynamic loads. Various experimental techniques and field optical methods, such as infrared camera IR, digital image correlation DIC, advanced electron microscopy SEM, etc., will be used.

A scheme of experimental methodology for Gum Metal under compression including field DIC techniques with the corresponding results is shown in Figure below.



Compression of Gum Metal: a) scheme of the process, b) selected curve of stress σ and temperature change ΔT vs. strain ε during the loading-unloading, DIC displacement fields in the end of loading: c) in loading direction, d) in direction perpendicular to Gum Metal loading.

Comprehensive research on compression tests in a wide range of strain rates related to the results obtained for tension, obtained in the scope of previously implemented projects, will expand knowledge of the innovative titanium alloys and may contribute to creation of new applications. The research will be conducted in collaboration with a Japanese research centers which provided us also with unique Gum Metal samples.

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2. Karol Golasiński, Elżbieta A. Pieczyska, Michał Maj, Maria Staszczak, Paweł Świec, Tadahiko Furuta, Shigeru Kuramoto, Investigation of strain rate sensitivity of Gum Metal under tension using digital image correlation, *Archives of Civil and Mechanical Engineering* (2020), DOI: 10.1007/s43452-020-00055-9.