GUM METAL SUBJECTED TO CYCLIC TENSION LOADING UP TO RUPTURE ANALYSED BY FAST AND SENSITIVE INFRARED CAMERA

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ABSTRACT: Gum Metal is a new multifunctional β titanium alloy combining high elasticity of rubber and strength of metal. The unique properties combined with high biocompatibility of the alloy create large application possibilities in biomedical, rehabilitation and sport facilities, as well as robotics, automotive and space industry. The alloy has been mechanically and thermomechanically investigated during subsequent loading-unloading tensile cycles. At the strain rate of $10^{-2}s^{-1}$ and step of 0.005 - 37 cycles until rupture were obtained. Effects of thermomechanical couplings were analysed. The mechanical characteristics, elaborated with high accuracy by digital image correlation (DIC), confirm the Gum Metal ultra-low elastic modulus and high strength, whereas the temperature distribution obtained with fast sensitive infrared camera system (IRT) demonstrates a strain localisation, leading to the specimen necking and rupture. The decrease in temperature accompanying the initial tensile loading (thermoelastic effect) usually indicates the material yield point. However, the maximal drop in the Gum Metal temperature occurs significantly earlier than the limit of its reversible strain. The result is quite different from those observed for other titanium alloys, steels and polymers. It means that such a large limit of the Gum Metal elastic reversible nonlinear deformation, underlined as the alloy "super property", follows from other deformation mechanisms, characterised by dissipative nature and temperature increase. It is probable that this is related to the micro elastic fields induced to the Gum Metal structure during the technology process.

Key words: (Gum Metal, cyclic loading, infrared camera, thermomechanical coupling, rupture)

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