

“ETTORE MAJORANA” FOUNDATION and CENTRE FOR SCIENTIFIC CULTURE  
INTERNATIONAL SCHOOL OF QUANTUM ELECTRONICS

64<sup>th</sup> Course: *PROGRESS IN PHOTOACOUSTIC & PHOTOTHERMAL PHENOMENA*

*Focus on BIOMEDICAL, NANOSCALE, NDE, GAS SENSING*

*and THERMOPHYSICAL PHENOMENA and TECHNOLOGIES*

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## **Workshop and International Summer School**

## Ti Alloy - Gum Metal Subjected to Compression in Wide Range of the Strain Rates

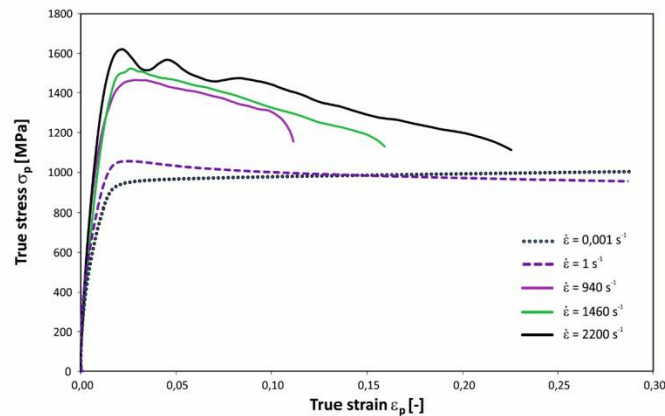
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Multifunctional  $\beta$ -Ti alloy named Gum Metal, characterized for the unique mechanical performance; low Young's modulus, large nonlinear recoverable deformation, and high strength, was developed by the *Toyota Central Research and Development Laboratories*. Initial results of the alloy characterization were published for the first time in *Science*, 2003 [1]. The research concerns investigation of Gum Metal in compression under quasi-static and dynamic loadings [2]. An MTS testing machine was used to measure the quasi-static behavior of the alloys with strain rates  $10^{-3} \text{ s}^{-1}$  and  $10^0 \text{ s}^{-1}$ . High strain rate uniaxial testing was performed using a Split Hopkinson Pressure Bar (SHPB) system obtaining strain rates of 940, 1460 and  $2200 \text{ s}^{-1}$ . In addition, the temperature change of the Gum Metal sample was estimated by using a fast and sensitive infrared camera. Cylindrical material samples of 5 mm x 5 mm were used.



It was found that Gum Metal is very sensitive to the strain rate applied also during the compression loading [3, 4]. Elastic-plastic transition during quasi-static compression of the Gum Metal appears at the stress level between 900 MPa and 1000 MPa, whereas under high strain rate loading condition the peak flow stresses are on the level between 1200-1400 MPa. Moreover, almost no strain hardening is observed for the strain rate of  $10^{-3} \text{ s}^{-1}$ . Strain softening is also visible for the strain rate of  $10^0 \text{ s}^{-1}$ , as well as for high strain rate range. The maximal temperature was obtained for the highest strain rate applied and equals to 326 °C.

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