

GUM METAL SUBJECTED TO TENSION AT VARIOUS STRAIN RATES - EXPERIMENTAL RESULTS ANALYSED BY DIC

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Gum Metal is a β Titanium alloy, characterized by high biocompatibility and unique mechanical properties; such as superelastic-like behavior and high strength. Due to the unique performance, the alloy is successfully applied in automotive, sport and biomedical industries. Nevertheless, the Gum Metal needs further investigation. Valuable information can be purchased from detailed analysis of its behaviour while loading at various strain rates.

The research concerns investigation of nucleation and development of strain localization phenomena during the alloy tensile loading at various strain rates: 10^{-1}s^{-1} , 10^{-2}s^{-1} and 10^{-3}s^{-1} . The experimental equipment consists of MTS 858 testing machine and a Manta G-125B charge-coupled device (CCD) camera. Digital image correlation (DIC) with especially developed algorithm was used to determine strain with high accuracy.

The obtained mechanical characteristics confirmed low elastic modulus and high strength of the alloy. The stress vs. strain characteristics present macroscopically observed phenomenon of slight work hardening for lower strain rate 10^{-3}s^{-1} , whereas softening for higher strain rates 10^{-1}s^{-1} and 10^{-2}s^{-1} . However, the curves character change when smaller virtual extensometer was used for DIC calculations. More detailed data was obtained from Hencky strain fields analysis, captured at selected stages of the loading process. The strain distributions showed that increase in the strain rate affects both the onset and development of the strain localization process. In the case of the lowest strain rate 10^{-3}s^{-1} the deformation is macroscopically uniform up to the mean strain value 0.08 whereas for the higher strain rate 10^{-2}s^{-1} and 10^{-1}s^{-1} the strain localization occurs at the earlier stage of the process and is localized in smaller area. The fractographs obtained after the specimen rupture exhibited mainly ductile features.

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References

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