Plastic behavior of a commercially pure titanium: mechanical characterization, modeling and validation using bulge tests

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ABSTRACT

In this paper, mechanical tests aimed at characterizing the plastic anisotropy of a commercially pure α-titanium sheet are presented. Hemispheric and elliptic bulge tests conducted to investigate the forming properties of the material are also reported. To model the particularities of the plastic response of the material the classical Hill [1] orthotropic yield criterion, and Cazacu et al.[2] orthotropic yield criterion are used. Identification of the material parameters involved in both criteria is based only on uniaxial test data, while their predictive capabilities are assessed through comparison with the bulge tests data. Both models reproduce qualitatively the experimental plastic strain distribution and the final thickness of the sheet. However, only Cazacu et al. [2] yield criterion, which accounts for both the anisotropy and tension-compression asymmetry of the material captures correctly plastic strain localization, in particular its directionality . Furthermore, analysis of the evolution of the thickness with the applied pressure shows that Cazacu et al. [2] criterion predicts better the behavior close to fracture.

REFERENCES

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