Shear Bands Formation in Different Engineering Materials Subjected to Dynamic Compression

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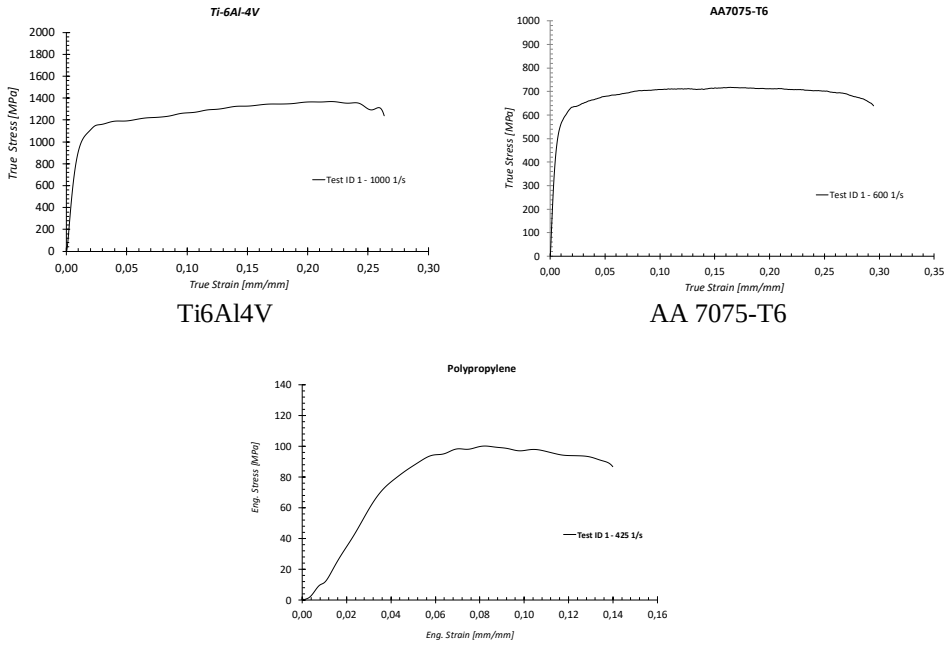
Abstract. During dynamic compression test different mechanism could occur resulting in a competing of strain hardening, strain rate hardening and thermal softening. The softening effects is also due to dynamic recovery and dynamic recrystallization [1–4]. If the hardening effects become less effective of softening ones the material could become unstable forming narrow bands in which the deformation concentrate involving (quasi) adiabatic conditions and an unpredicted catastrophic failure occurs. These narrow bands are so called Adiabatic Shearing Bands (ASB).
The same instability could express itself in some polymeric materials due to combination between temperature and strain rate. The inhomogeneuos deformation during compression consist a plastic strain concentration in shear bands approximately 1 μm thick containing a shear strain of about higher that the rest of the material that remains completely undeformed [5–7].
In this work, an analysis about adiabatic shear bands and micro-shear bands on three different types of materials is described. Compression tests of Titanium alloy (Ti-4Al-6V), Aluminum alloy (AA 7075-T6) and Polymeric material (Polypropylene: PP) have been carried out in quasi-static and dynamic condition (**Figure 1**). A direct version of Split Hopkinson Bar has been used [8].

Ti6Al4V AA 7075-T6 PP

Figure 1. Samples for the three different materials

The results are presented in term of:
1. engineering/true stress- train curves; some the results obtained with samples tested in dynamic conditions are shown in **Figure 2**, and
2. optical analysis of tested samples.



Ti6Al4V AA 7075-T6

PP

Figure 2. True/Engineering stress-strain curves

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