Adiabatic shear bands in magnesium alloys: Experimental and theoretical analysis

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ABSTRACT

Adiabatic shear bands (ASBs) or adiabatic shear localizations are a common phenomenon caused by thermal accumulation in a local area in metallic materials subjected to a high strain rates deformation. And the formation of ASBs depends on a number of metallurgical parameters, and their formation is often a precursor to catastrophic failures. In this paper, the Split Hopkinson Pressure Bar (SHPB) was used testing the ASBs behavior of magnesium alloys, and it was demonstrated that three types of ASBs featured by different microstructure appearance were found in magnesium alloys. The microstructure within ASBs in the first type is very fine equiaxed grain, and adjacent of ASBs, the microstructure consists of high density twins. The microstructure in second type of ASBs is featured by twinning bands. And these two types of ASBs were observed in AZ31 magnesium alloy. The third type of ASBs was found in Mg–Gd–Y rear earth bead magnesium alloys, and it is featured by white bands. The numerical simulation of the stress and temperature field during the adiabatic shear band formation was also conducted to assist the theoretical analysis of ASB in magnesium alloys.

KEYWORDS: magnesium alloy, adiabatic shear bands, numerical simulation