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Dynamic impact response of cryorolled AA 7055 aluminum alloy

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A 7055 aluminum alloy was strengthened using a combination of cryorolling followed by flash annealing and precipitation hardening. The as-received AA 7055-T7751 alloy was first solutionized at 470 °C for 1.5 hours, water quenched, cryorolled at -150 °C and finally age-hardened at 120 °C for 8 hours. The mechanical behavior of the strengthened alloy under compressive load at strain rates of between 900 and 6000/s was investigated using split Hopkinson pressure bar system. The dynamic impact response of the cryorolled alloy is compared with that of the as-received commercial AA 7055-T7751 alloy. Their dynamic stress-strain curves under impact loading are compared and discussed in relation to the simultaneous occurrence of thermal softening and strain hardening during the high strain-rate deformation. Significant increase in strength of the alloy occurred as a result of the intermediate cryorolling process. The microstructures of both the as-received and cryorolled alloy specimens, before and after impact loading were investigated using scanning and transmission electron microscopes. The cryorolled specimens were characterized by substantial dislocation pile-ups along with the grain boundaries of the cryorolled specimens. The significant increase in strength of the cryorolled alloy is accompanied by lower resistance to fracture under impact loading. Heterogeneous deformation leading to shear strain localization along adiabatic shear bands occurred in the alloy specimens when deformed at strain rates above 3000/s. Deformation was however observed to be relatively homogeneous when deformed at lower strain rates. The susceptibility of the alloy to adiabatic shear failure is considerably influenced by the processing conditions.

Biography

Akindele G Odeshi has pursued his BSc and MSc degrees in Metallurgical and Materials Engineering from the Federal University of Technology Akure, Nigeria. He has completed his Doctorate degree in Materials Engineering from Technische Universitaet Chemnitz, Germany. He is currently an Associate Professor in the Department of Mechanical Engineering, University of Saskatchewan Saskatoon, Canada. He is a licensed Professional Engineer (Canada), an active Researcher and a Seasoned Educator. He has published over 50 articles in reputable journals and over 50 conference papers in reputable conference proceedings.

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