# Deformation Behavior of Ultrafine Grained A356 Material Processed by Cryorolling and Development of Johnson–Cook Model

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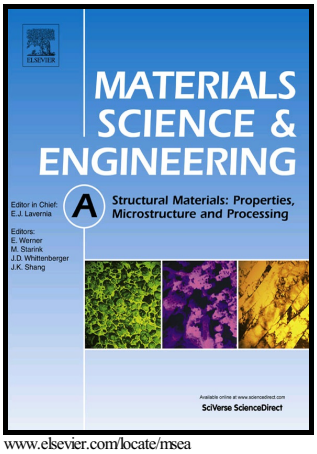


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# Deformation Behavior of Ultrafine Grained A356 Material Processed by Cryorolling and Development of Johnson–Cook Model

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## Abstract

The present research work focuses on understanding the deformation behavior of cryorolled A356 material at various strain rates ranging from 0.001 $s^{-1}$ – 10 $s^{-1}$ in the temperature range of 25 ºC – 400 ºC. Microstructure of the material at each deformation temperature was characterized to completely analyze the material's behavior. Presence of ultrafine grained microstructure with highly unstable dislocation networks were found to play a major role in strengthening the material up to the deformation temperature of 200 ºC. Recrystallization and thermal softening decreases the material's strength at deformation temperatures beyond 200 ºC. With respect to the rate of deformation, a prominent change in the deformation mechanism is observed at strain rates higher than 1 $s^{-1}$. The failure mechanism at various strain rate and temperature ranges is studied in detail. Finally a constitutive Johnson-Cook model is developed to predict the material's flow behavior for the range of strain-rates and temperatures under study.

Graphical abstract: