Strain hardening behaviour in sintered Fe–0.8%C–1.0%Si–0.8%Cu powder metallurgy preform during cold upsetting

A Rajeshkannan* and **S Narayan**
Mechanical Engineering, The University of the South Pacific, Suva, Fiji

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Abstract: Cold upsetting experiments were performed on sintered Fe–0.8%C–1.0%Si–0.8%Cu steel preforms in order to evaluate the strain hardening characteristics. Powder preforms of 86 per cent theoretical density and an initial aspect ratio of 0.4 were prepared using a suitable die and a 1 MN capacity hydraulic press. Sintering was carried out in an electric muffle furnace for a period of 90 min at 1150 °C. Each sintered compact was subjected to an incremental compressive loading of 0.04 MN until fractures appeared on the free surface. Experiments were performed with no lubricant and using graphite as a lubricant. The behaviour of the applied stress as a function of both strain and densification level exhibits a continuous enhancement over three different response modes. The first and third stage responses offer a high resistance to deformation, whereas the second stage shows virtually steady-state behaviour. The instantaneous strain hardening exponent n_i and strength coefficient K_i of the steel preforms were calculated and found to continuously increase with an increase in the deformation and densification levels.

Keywords: cold upsetting, applied stresses, strain, densification, strain hardening