uous cooling after hot forming is proposed. It is based on incremental formulation of conventional nucleation and grain growth theory, and dislocation density is introduced to describe the effect of hot forming to phase transformation. Upsetting experiments under different cooling rates, plastic strains and deformation temperatures are performed to validate the accuracy of the proposed model. The proposed model has been applied to simulate phase transformation and final microstructure after 4-pass bar rolling.

(cf. *ISIJ Int.*, **41** (2001), 1510)

Development of grain interior strain localizations during plane strain deformation of a deep drawing quality sheet steel

V.M.NANDEDKAR et al.

Development of dislocation substructures was characterized in an aluminum killed deep drawing quality steel at four different plane strain deformations. At and above 20% reduction, the most significant substructural feature was micro bands (MBs). MBs appeared as paired dislocation walls of 0.2–0.4 μm thickness and were always at an angle of approximately 37° with rolling direction (RD). As the traces of the MBs were more than 5° of {110} and {112}, closed packed planes of the bcc system,—they were termed as first generation[1] or non-crystallographic using the convention[16] commonly used in fcc metals. Other than the pre-deformation high angle boundaries, MBs were the only feature with large enough misorientations necessary for optical visibility. At least for the range of strain and strain path used in the present study, the first generation MBs can be considered as the so-called grain interior strain localizations. Relative presence and effectiveness of MBs were quantified in different microtexture components from the MB spacings along TD (λ) and the average misorientation across MBs (θ_{MB}) and these appear to determine the stored energies of different microtexture components.

(cf. *ISIJ Int.*, **41** (2001), 1517)

Physical Properties

Thermal diffusivity of iron at high temperature in both the liquid and solid states

B.J.MONAGHAN et al.

Thermal diffusivity measurements of pure iron have been made using a laser flash apparatus (LFA) over the temperature range 25 to 1 640°C. These measurements are compared with existing data and recommended values are given. In the γ-Fe phase region the thermal diffusivity can be represented by $a=6\times10^{-6}+3.13\times10^{-9}\times(T-911)$. In the δ-Fe phase region the thermal diffusivity can be represented by the constant $0.07\times10^{-4}\,m^2s^{-1}$. In the liquid region up to 1 640°C, the thermal diffusivity can be represented by $a=6.2\times10^{-6}+1.79\times10^{-9}\times(T-1\,538)$. T in both equations is temperature in Celsius and the thermal diffusivity equation units are m^2s^{-1}.

To improve the LFA measurement characteristics of a metal, it is often coated with graphite. Unfortunately, due to the solubility of carbon in iron, at high temperatures, the coating does not remain on the surface of the iron. The effect of using a zirconia coating as opposed to a graphite coating was tested. The efficacy of this change was evaluated by comparing thermal diffusivity measurements on Cu using both coating materials.

(cf. *ISIJ Int.*, **41** (2001), 1524)

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