Microstructure and annealing behavior of a modified 9Cr-1Mo steel after dynamic plastic deformation to different strains

The microstructure, hardness and tensile properties of a modified 9Cr-1Mo steel processed by dynamic plastic deformation (DPD) to different strains (0.5 and 2.3) have been investigated in the as-deformed and annealed conditions. It is found that significant structural refinement and a high level of strength can be achieved by DPD to a strain of 2.3, and that the microstructure at this strain contains a large fraction of high angle boundaries. The ductility of the DPD processed steel is however low. Considerable structural coarsening of the deformed microstructure without pronounced recrystallization takes place during annealing of the low-strain and high-strain samples for 1 h at 650 °C and 600 °C, respectively. Both coarsening and partial recrystallization occur in the high-strain sample during annealing at 650 °C for 1 h. For this sample, it is found that whereas coarsening alone results in a loss of strength with only a small gain in ductility, coarsening combined with pronounced partial recrystallization enables a combination of appreciably increased ductility and comparatively high strength.