Modelling isothermal and non-isothermal recrystallisation kinetics: Application to Zircaloy-4

Abstract

This paper considers the modelling of recovery and recrystallisation of single phased metals. The recrystallisation nucle-ation model of Zurob et al. [H. Zurob, Y. Bréchet, J. Dunlop, Acta Mater. 54 (2006) 3983] has been extended to allow for recrystallisation growth and the concurrent recovery in the non-recrystallised grains. The input parameters of the model are physically based and can be measured, being the recovery kinetics and boundary mobility. Output from the model gives critical strains and temperatures for recrystallisation, and the recrystallisation kinetics. As an example the model is applied to the recovery and recrystallisation kinetics of Zircaloy-4. The grain boundary mobility is not well known for this material, and so it is taken to be a free parameter with a temperature dependence coming from the Turnbull mobility. The model successfully describes recovery kinetics of Zircaloy-4, and once the mobility has been estimated gives good predictions of critical temperatures and strains as well as the kinetics of recrystallisation under non-isothermal heat treatments.

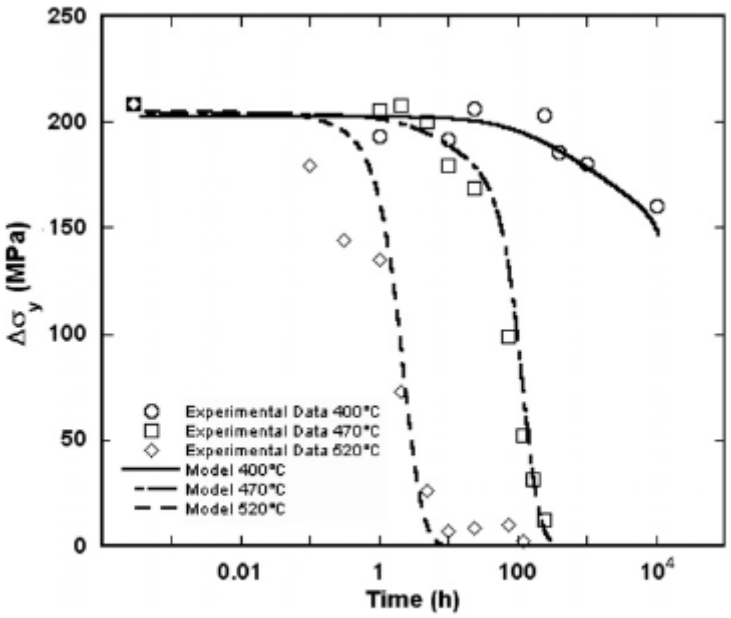

Fig. 2. Softening kinetics of Zircaloy-4 as measured from Vickers hardness compared to the model output.