Kinetics of dissolution of liquid Pb nano-inclusions attached to a dislocation in aluminum

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Dissolution of liquid Pb inclusions attached to a fixed dislocation in $Al_{99.5}Pb_{0.5}$ alloy at 525°C, 542°C and 543°C is studied. The dissolving inclusions were observed *in-situ* using TEM from their initial sizes of about 30 nm until their complete disappearance, Fig. 1. The inclusion sizes as a function of time (Fig. 2) were obtained from video records of their dissolution.

The interaction of a dissolving liquid inclusion with neighboring inclusions on a dislocation by means of Pb atomic diffusion along the dislocation core is assumed to analyze the kinetics of the dissolution. The equation obtained in the frameworks of this model describes well the dissolution kinetics, Fig. 2. The parameter $c_d D_d$ (c_d is the solubility of Pb in the dislocation core in Al, and D_d is the diffusivity of Pb along the dislocation core in Al) is evaluated.

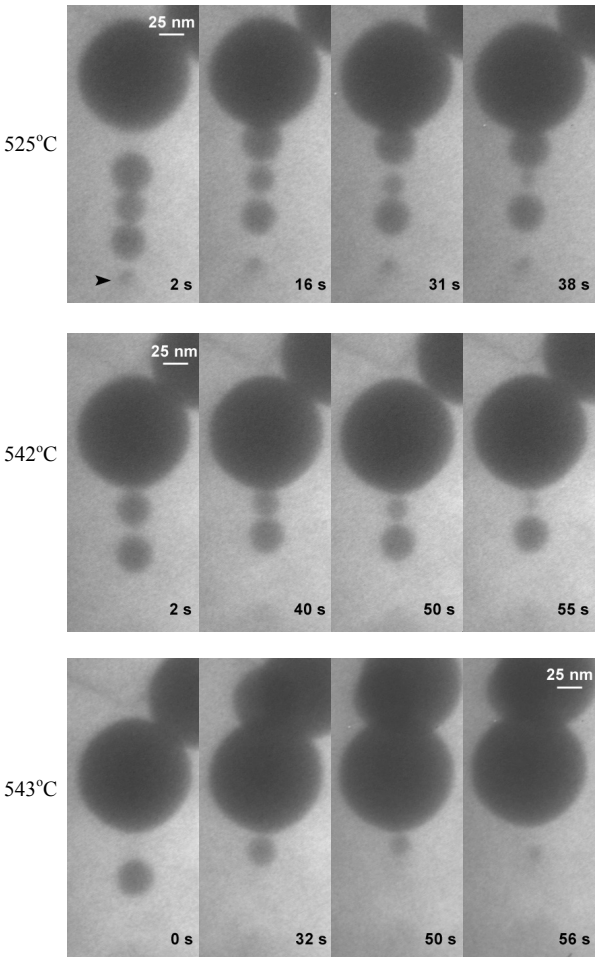

Fig.1. *In-situ* TEM observations of dissolution of the inclusions. The arrow shows termination of the dislocation at the free surface of the foil.

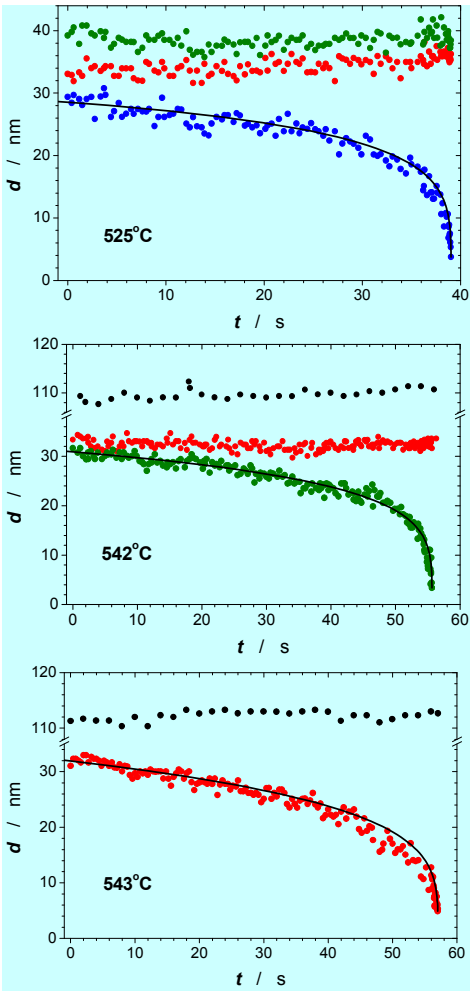

Fig.2. The kinetic dependence of the dissolution of the inclusions. The solid lines show the fits by the kinetic equation deduced from the model.