

DSM Science & Technology Awards 2004

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My PhD work was conducted in the framework of the STW project 'Simultaneous study of nucleation and growth processes during phase transformations in steel by means of neutron depolarization' (DST.4609). My PhD work involved in-situ experimental observations on the decomposition of austenite into ferrite and pearlite in carbon steel by neutron and synchrotron techniques. These unique observations were related to physical models that describe the phase transformation kinetics as grain nucleation and growth processes. For this purpose we performed experiments at national and international neutron and synchrotron facilities that involved three-dimensional neutron depolarization (3DND) at the IRI in Delft, small-angle neutron scattering (SANS) at ISIS in the UK and HMI in Germany, and 3DXRD microscopy at the ESRF in France. These scattering techniques overcome the limitations of traditional experimental techniques by giving in-situ information about the nucleation and growth rates in the bulk of steel. The experimental results indicate nucleation and growth mechanisms that deviate from conventional assumptions and formed the input for physical phase transformation models. Scientifically the project has been very productive with 10 scientific papers (see list of Publications), of which five on neutron depolarization results and one, recently published in Science, on 3DXRD results. The project is extended until 1 May 2004 with a post-doc position for me. The extension of the project is financially supported by three metal producing and processing companies in the Netherlands, Corus, Fundia Nedstaal, and SKF, in order to analyze the remaining experimental 3DXRD data that were obtained during the PhD-project.