M08.0D Applications of Line Broadening

Chair: D. Balzar
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Attendance: 114

The organizers' intent was to present the current status in diffraction line broadening analysis and its modeling in terms of underlying microstructure. Regardless of a rainless Sunday morning, the attendance was very good. Unfortunately, the first lecture scheduled, Analysis of X-Ray Diffraction Line Broadening in Structurally Inhomogeneous Polycrystalline Materials by Peter Klimanek (Freiberg University, Germany), had to be canceled because of the speaker's illness. Therefore, Eric J. Mittemeijer (Max Planck Institute for Metal Research, Stuttgart, Germany) opened the session by the talk Diffraction-Line Broadening by Lattice Imperfections; Analysis Through Line-Profile Synthesis. As always, the speaker presented some fresh ideas and a critical review of previous well-established theories. Next two lectures have focused on two main aspects of diffraction line broadening: size-related and strain-related effects. J. Ian Langford (University of Birmingham, England) discussed the influence of a crystallite size distribution on size-broadened profiles, while focusing especially on a log-normal distribution. The lecture was a comprehensive review of the topic, although just a small fraction of his original contribution to the field. This lecture was complemented by Tamas Ungar (Eotvos University, Budapest, Hungary), who gave an overview of the anisotropic broadening by dislocations. He emphasized the connection between the Warren-Averbach type of analysis with analysis of dislocation densities, as given by the Krivoglaz-Wilkens school. Peter W. Stephens (SUNY at Stony Brook, New York) told of a novel approach to model the anisotropic line broadening in Rietveld programs. As opposed to most of the existing models, this method is very versatile and applicable to a general case of a triclinic crystalline symmetry. The last lecture in the microsymposium, Precipitate-Related Strain in Reactor-Pressure-Vessel Steels, was presented by Davor Balzar (NIST, Boulder, Colorado), as a replacement for the Peter Klimanek's talk. Described was an interesting application of diffraction line-broadening analysis to a problem of nuclear reactor containment-vessel embrittlement. The microsymposium was extended well into a lunch break because of some long but very interesting lectures and discussions. The session showed that line-broadening analysis is a small but a lively field of crystallography. At present, there is an increasing interest in the simultaneous analysis of a number of technologically important properties of polycrystalline materials, as e.g. dislocation densities and configurations, abundance of planar defects, such as stacking and twin faults, and crystallite size and shape. These possibilities come into view because of the increasing ease of modeling of the full powder pattern directly in terms of the physical parameters of interest.

Davor Balzar and Robert Delhez