QTA helps structure and residual stress determinations within the Combined Analysis scheme

Daniel Chateigner*[1], Barbara Maëstracci[2], Doriana Vinci[3], and Luca Lutterotti[4]

[1]CRISMAT-CNRS, IUT Caen – Université de Caen Normandie, Normandie Université; CRISMAT-ENSICAEN, IUT-Caen, Université de Caen Normandie, Caen, France – France
[2]Institut Saint-Louis – 2French-German Research Institute of Saint-Louis, Saint-Louis – France
[3]Karlsruhe Institute of Technology – Germany
[4]Dipartimento di Ingegneria Industriale [Trento] – Italy

Abstract

The "Combined Analysis" methodology is able to quantify many information from ray scattering experiments: structure, texture, residual stresses, phase contents, reflectivity, fluorescence, Raman ...
The core of this methodology relies on full pattern analyses (*e.g.* Rietveld analysis for structure), using refinements of data based on physical models which target the various parameters of interests (atomic positions, ODF, layers' thickness, element % ...). Since the scattered signals depend on all these parameters, a global refinement using all the measured datasets seems the best approach to take account and refine all contributions at once, hereby getting an optimized solution able to model the observation. This has been the development track of Combined Analysis since the beginning. However, in front of the numerous measured data and parameters to refine, one might at some point question the validity of the approach. Specifically since many refined parameters are correlated (*e.g.* diffracted intensities vary upon both structure and texture, line shifts may be associated to structure and stress ...) and since, after 25 years of development, the method is relatively easy to practice. Is it too good to be true ?
After an illustration of the powerfulness of Combined Analysis on a complex case, we propose in this presentation, to show two case studies which are validating the approach. The first one illustrates how Combined Analysis is able to decorrelate structure and ODF information on several textured samples. The second one shows how the global refinement can efficiently use the QTA scans to determine the unstressed unit-cell in residual stress analysis of a textured sample.

Keywords: Combined Analysis, Residual stresses, Structure

*Speaker