Preface

For the last ten years *Zeitschrift für Kristallographie* has published some 16 special issues that have covered a broad spectrum of crystallographic concepts. The idea behind these special issues is to cover current crystallographic hot topics through invited contributions by leading experts in their respective fields and these issues have become a well respected overview over very interesting crystallographic developments over the past ten years.

This special issue devoted to **Analysis of Complex Materials** through the application and analysis of the pair distribution function (PDF) is in a sense a double special issue as it covers a topic that was reviewed already in the 2004 special issue Structure of Complex Materials (3/2004). The need for a new special issue is a good sign of the fast development that this field experiences. Another indication for this healthy development is the number of instruments that are devoted to a large extend or entirely to powder diffraction with the purpose of PDF analysis. Initially most of the published papers originated at the NPDF instrument at the Los Alamos Neutron Science Center (LANSCE) and ID-11-B at the Advanced Photon Source, Argonne. By now several dedicated instruments have been built or are proposed while other powder instruments experience an increased user demand in the PDF direction. Among these are NOMAD at the SNS, NOVA at J-PARC, GEM and POLARIS at ISIS, D4 at the ILL and proposed instruments at PETRA III, and DIAMOND, hopefully at the upcoming ESS as well. This list is certainly not complete and we expect it to expand, both at X-ray and at neutron facilities.

With this special issue, we would like to support this development and to point out future directions which the PDF method seems to take on. While the PDF technique has so far been limited to experiments at large scale X-ray and neutron facilities, recent developments open up in-house diffraction experiments that are available year round. Another new development is the use of electron diffraction, which could open up a huge amount of instruments to the analysis of the local structure of complex materials. Interestingly enough, the PDF community has not forgotten one of its main roots, the analysis of disordered materials by diffuse single crystal work and may actually come back to unit these two seemingly contradictory approaches. At the same time, the development at the large scale facilities has not stopped and measurement times have dropped from some 24 hours to fractions of a second, a fact that now allows to study kinetics. If you are content with a bit longer measurement time yet crave for faster processes within your sample, you might look into the analysis of dynamics in disordered materials. Finally, complementary experiments with X-ray absorption techniques have long since been used to study the local structure with sensitivity to the chemical nature of the individual atoms. Traditionally, PDF has been blind to distinguish different atoms, unless X-ray and neutron data were combined, which gave at least a partial insight. With the use of anomalous powder diffraction even this blindness may be cured.

The papers in this special issue describe each of these exciting new developments of the PDF technique together with recent applications. These applications were chosen to illustrate the wide range of materials to which the PDF technique can be applied. They can, of course, only be a small glimpse into the PDF universe. We hope that the reader will find all these papers enjoyable and that they may serve as a source of new inspirations.

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