

Themed issues of *Acta Crystallographica Section A* on phase transitions

Dhananjai Pandey

School of Materials Science and
Technology, Institute of
Technology, Banaras Hindu
University, Varanasi 221 005, UP,
India

Acta Crystallographica Section A: Foundations of Crystallography is the leading forum for publishing papers related to fundamental advances in all areas of crystallography in the broadest sense. At a meeting of the Editorial Board of *Acta A* held at the Schloss Bottstein, Villigen, near the Swiss Synchrotron source at the Paul Scherrer Institute, it was decided to publish special themed issues on topics of interdisciplinary interests where crystallographic tools and techniques have played very significant roles. The field of phase transitions is truly interdisciplinary in nature and continues to be actively pursued by physicists, chemists, earth scientists, materials scientists and metallurgists in different parts of the world. Accordingly it was decided to bring out one themed issue on phase transitions containing about 20 invited topical reviews/overviews covering important recent developments in the field. The present issue containing nine articles is an outcome of this initiative. It is expected that another issue of *Acta A* with about ten more articles will follow the present one in the near future covering other aspects of phase transitions.

The first article by Salje *et al.* reviews the progress made in the use of Landau-type theories to study the ferroelastic phase transitions at three different levels, *viz* the crystal structure, the microstructure and the mesostructure levels.

This is followed by four articles on different aspects of phase transitions in aperiodic crystals. Pan & Chapuis present an overview of their recent work on the simulation of experimentally measured diffraction effects due to incommensurate structures and their phase transitions in organic crystals using molecular dynamics techniques with generic force field. Steurer presents a comprehensive review of the different types of experimentally observed amorphous-to-quasicrystalline, quasicrystalline-to-ordered/disordered-quasicrystalline and quasicrystalline-to-crystalline phase transitions as a function of temperature, pressure and irradiation, as well as high-energy ball milling. Next follows a critical review by Sato of the progress made in the experimental understanding of magnetic quasicrystals, especially from the point of view of the nature of spin freezing at low temperatures. The next article by van Smaalen gives an overview of phase transitions in low-dimensional electronic crystals towards a low-temperature charge density wave state and the application of X-ray diffraction as a tool to obtain quantitative information about such transitions.

The sixth article turns towards yet another facet of phase transitions of topical interest. In this article, Moret reviews orientational ordering phase transitions and glass transitions of C₆₀ as a function of temperature and pressure along with a summary of polymerization processes under high-pressure–high-temperature conditions as well as *via* doping by alkali metals.

The next two articles deal with phase transitions in perovskites. Hadermann *et al.* present a review of electron diffraction and high-resolution electron-microscopic studies on the structural transitions in anion-deficient oxide perovskites with special emphasis on the need to understand the role of local structures in arriving at the correct crystallographic structure. In the next article by Howard & Stokes, a review of the applications of the computer program *ISOTROPY* to the structures and phase transitions in perovskites is presented. This is illustrated by a number of cases where the determination of the perovskite structure has been greatly assisted by group-theoretical analysis of phase transitions.

The last article by Clegg is a short review of recent X-ray diffraction studies on phase transitions in thermotropic liquid crystals along with a brief discussion of the open questions related to various aspects of these transitions.

The importance of crystallographic techniques and tools in unravelling the diverse aspects of phase transitions is amply reflected through the articles presented in this

special issue. It is this common link, other than that all the articles pertain to the broad field of phase transitions, that justifies the present issue.

I take this opportunity to thank Professor André Authier, the former Section Editor of *Acta A*, and Professor Dieter Schwarzenbach, the present Section Editor of *Acta A*, for their constant encouragement, interest and valuable suggestions starting from the day of the conceptualization of this project. I also thank Professor John Helliwell, Editor-in-Chief of *Acta Crystallographica* journals and Chairman of the Commission on Journals of the IUCr for accepting the proposal of the Section Editor to produce this special issue. Last but not least, the silent hard work of the Chester staff, especially Ms Sue Barnes, is gratefully acknowledged.