PREFACE

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PREFACE

Exploring surfaces and buried interfaces of functional materials by advanced x-ray and neutron techniques

Guest Editor
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This special issue is devoted to describing recent applications of x-ray and neutron scattering techniques to the exploration of surfaces and buried interfaces of various functional materials. Unlike many other surface-sensitive methods, these techniques do not require ultra high vacuum, and therefore, a variety of real and complicated surfaces fall within the scope of analysis. It must be particularly emphasized that the techniques are capable of seeing even buried function interfaces as well as the surface. Furthermore, the information, which ranges from the atomic to mesoscopic scale, is highly quantitative and reproducible. The non-destructive nature of the techniques is another important advantage of using x-rays and neutrons, when compared with other atomic-scale analyses. This ensures that the same specimen can be measured by other techniques. Such features are fairly attractive when exploring multilayered materials with nanostructures (dots, tubes, wires, etc), which are finding applications in electronic, magnetic, optical and other devices.

The Japan Applied Physics Society has established a group to develop the research field of studying buried function interfaces with x-rays and neutrons. As the methods can be applied to almost all types of materials, from semiconductor and electronic devices to soft materials, participants have fairly different backgrounds but share a common interest in state-of-the-art x-ray and neutron techniques and sophisticated applications. A series of workshops has been organized almost every year since 2001. Some international interactions have been continued intensively, although the community is part of a Japanese society.

This special issue does not report the proceedings of the recent workshop, although all the authors are in some way involved in the activities of the above society. Initially, we intended to collect quite long overview papers, including the authors’ latest and most important original results, as well as updates on recent progress and global trends in the field. We planned to cover quite a wide area of surface and buried interface science with x-rays and neutrons. Following a great deal of discussion during the editing process, we have decided to change direction. As we intend to publish similar special issues on a frequent basis, we will not insist on editing this issue as systematic and complete collections of research. Many authors decided to write an ordinary research paper rather than an article including systematic accounts. Due to this change in policy, some authors declined to contribute, and the number of papers is now just 12. However, readers will find that the special issue gives an interesting collection of new original research in surface and buried interface studies with x-rays and neutrons. The 12 papers cover the following research topics: (1) polymer analysis by diffuse scattering; (2) discussion of the electrochemical solid–liquid interface by synchrotron x-ray diffraction; (3) analysis of capped nanodots by grazing incidence small-angle x-ray scattering (GISAXS); (4) discussion of the strain distribution in silicon by high-resolution x-ray diffraction; (5) study of...
mesoporous structures by a combination of x-ray reflectivity and GISAXS; (6) discussion of energy-dispersive x-ray reflectometry and its applications; (7) neutron reflectivity studies on hydrogen terminated silicon interface; (8) the fabrication and performance of a special mirror for water windows; (9) depth selective analysis by total-reflection x-ray diffraction; (10) nanoparticle thin films prepared by a gas deposition technique; (11) discussion of crystal truncation rod (CTR) scattering of semiconductor nanostructures; (12) magnetic structure analysis of thin films by polarized neutron reflectivity. While not discussed in the present special issue, x-ray and neutron techniques have made great progress. The most important steps forward have been in 2D/3D real-space imaging, and realtime measurement. Advances in such technologies are bringing with them new opportunities in surface and buried interface science. In the not too distant future, we will publish a special issue or a book detailing such progress.