quick guide to fix the possibility of eclipses in the month.

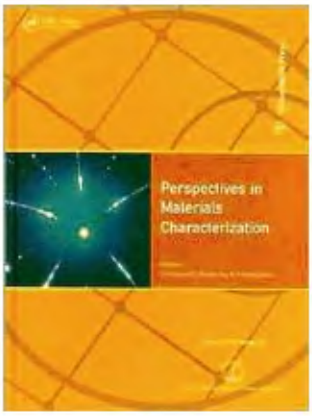
The location of the sun in the sky is a direct indication of the time of the year. In most parts of Karnataka the agriculturists refer to the seasonal rains by the names of stars. These are the same 27 stars that are used to reckon the location of the moon in the sky. Thus the association of the same name to the rain implies the location of the sun in the sky. For example, the rains associated with *Mrigashira* and *Ardra* are generally the heaviest and occur in July/August. This corresponds to the position of sun near those stars. The tradition of associating the star name with rain (indirectly the sun) appears to have deep roots in the 27 star calendar system which was in circulation before the advent of the zodiacal constellations attributed to Greek invasion.

There is an additional chapter called *Niradarka Vicharah* by the commentator Sumatiharsha. This contains only six verses. The first three refer to the calculation to be done for fixing the 'star' for the sun. Perhaps this was needed for agricultural purposes, since many farmers decide the date of sowing the seeds after consultation with local pundits who give them the dates of 'rain stars'. The duration of a 'rain star' is about 13–15 days and from generations the information about right 'star' for sowing has been passed on. However, the other three verses appear to be purely of astrological interest and convey notings relevant to astronomers. They specify the planetary positions for good rains.

The authors have taken great pain in translation as well as in providing numerical examples. The book serves as a very useful tool for people who want to explore the depths of Indian astronomy. However, this text is no exception to the general observation that Indian authors shy away from providing diagrams explaining the concepts, which is vital in understanding the 3-D celestial sphere. Bhaskaracharya has provided hints on drawings for understanding – these are termed *parilekhana*. Corresponding drawings would have added to the clarity in reading. Otherwise as one reads through, a mental picture of the associated drawing will have to be created. This may not be possible for many readers. It would be nice if diagrams as per *parilekhana* are incorporated in future editions, which can also have an index at the end, of subjects and *shlokas*. It may be better to have the verses printed in Devanagari script. A glossary and a cross-reference of technical terms like *deshantara*, *sara*, *chapa* and so on may be incorporated. A preliminary table on the representation of numbers, for e.g. 7^R, *kala*, *vikala* also would be very handy for people from different backgrounds.

B. S. SHYLAJA

Jawaharlal Nehru Planetarium,
High Grounds,
Bangalore 560 001, India
e-mail: shylaja.jnp@gmail.com



Perspectives in Materials Characterization. G. Amarendra, Baldev Raj and M. H. Manghnani (eds). University Press, 2009. 183 pp. Price not mentioned.

The importance of materials in the evolution of mankind has long been recognized by historians when they categorized the periods of human civilizations (Bronze Age, Iron Age) in terms of the type of materials invented during that period. In the antiquity, the ability to manipulate materials for useful purposes was more of an art than science. Perhaps, the alchemists were among the people who could create new types of materials through secret 'tricks'. The systematic discovery of elements and their consolidation in the form of a periodic table two centuries ago by Mendelev heralded a new beginning in the very thinking process of dealing with matter as a whole. The subsequent developments in physics and chemistry offered a variety of theoretical and experimental tools for quantitative characterization of matter in terms of the constituents, their arrangements in space, internal dynamics, and their relationships with the different physical properties. Armed with such an extensive range of characterization tools and the pace at which various disciplines (biology, chemistry, physics, metallurgy and other engineering disciplines) have come closer in the past two to three decades, it may not be so outrageous to speculate that in the years to come the materials scientists may as well be known as new-age-alchemists. The very interdisciplinary character of Materials Science offers exciting opportunities for doing new things. Many of the technological solutions to some of the pressing issues of the contemporary world such as energy, health and environment, will significantly depend upon the development of novel materials and processes. Regular updates of the new developments are therefore essential on various aspects of materials research from time to time.

The characterization tools in Materials Science are very diverse in nature and no single book can discuss exhaustively all topics of interest without comprising on its size and weight. One may cite two books: (i) *ASM Handbook*, Volume 10, *Materials Characterization* (ASM International, 1998) and (ii) *Characterization of Materials*, Volume 1 and 2 edited by Elton N. Kaufmann (Wiley-Interscience, 2003) in this context. Also, often such 'bulky' volumes focus on the traditional areas of characterization, sometime highlighting some of the new developments in that field. For readers interested only in some specific topics, along with the most recent updates, he/she would prefer a friendly-sized book. This aspect is taken care of in the book *Perspectives in Materials Characterization* under review. This new book, of about 200 pages, is published by the University Press as a part of the series in Metallurgy and Materials Science and is a sequel to a previous volume *Advances in Materials Characterization* published two years ago (in 2007) in which a broad overview of the developments in scanning tunneling microscopy, transmission electron microscopy, confocal microscopy, defect characterization using positron annihilation spectroscopy and Brillouin scattering has been presented. The new book, with glossy pages, contains five chapters on different themes (Raman, Micro-Laue diffraction, Ion beams, piezospectroscopy and X-ray spectroscopy). Each chapter gives the essential concepts of the technique, followed by examples from published literature. It may be pointed out that as compared to the first book, which emphasized more on elaborating the additional developments in the traditional characterization tools, the present book contains at least two chapters (Chapter 2: 'Polychromatic Microdiffraction Studies of Inhomogeneous Deformation' by E. Ice *et al.* and Chapter 4: 'Piezo-spectroscopic Methods for the Quantitative Assessment of Stress in Ceramics and Semiconductor Compounds', by G. Pezzotti) that highlight the development of altogether new techniques for three-dimensional comprehensive characterization of microstructure and stress fields at submicroscopic length scales. Traditionally, Laue diffraction is used for determining orientation of single crystals. The high brilliance of synchrotron beam and the ability to focus it to a submicron spot size has made it possible to determine the orientation of individual grains in a polycrystalline material. By scanning the incident beam across a chosen area and recording the Laue patterns, this technique has, in principle, the potential to determine not only the orientation of the different grains bathed in the incident beam during the scanning process, but is also capable of mapping the local elastic strain tensor, and the dislocation tensor in 3D, which are important parameters for developing models to describe deformation behaviour of materials at mesoscopic length scales. The chapter nicely presents the essential concepts involved, supplemented by colourful illustrations. The usefulness of this technique has been demonstrated for three case studies: (i) inhomogeneous grain rotations during mechanical deformation of a polycrystalline Ni, (ii) measurement of elastic strain and plastic deformation during electromigration and (iii) plastic deformation in near welds. Part of the instrumental aspect of the technique is still under development, and once realized, this technique will be one of the most sought-after techniques for a comprehensive non-destructive micro–physico–structural evaluation of materials.

The next chapter (chapter 4) deals with another very recent development in the field of three-dimensional mapping of residual stress in the coatings of ceramics and semiconductors using piezospectroscopic method. Piezospectroscopy, per se, is not a new concept. Measurement of high pressure in diamond anvil cells (DACs) makes use of one such method (the shift of Cr^{3+} fluorescence band frequency of a Ruby particle is used as a measure of the pressure in DACs). Similarly, the change in the frequency of some of the Raman bands of a material with pressure can also be used as a calibration for measurement of stress in a crystalline specimen. These traditional piezospectroscopic methods give average value of stress over the laser illuminated volume. Stress distribution, even if present in such a volume, cannot be quantified. It is well known that stress field gradients near the coating–substrate interface determines the integrity of a coating, and hence such studies are of highest importance from the technological point of view. The chapter explains how stress distribution can be quantified at the length scale of micron and submicron using the depth resolution feature of confocal microscopes (the principle of which has been explained in the fifth chapter of the preceding book *Advances in Materials Characterization* of this series) and also by studying the cathodoluminescence (CL) spectra in scanning electron microscope (SEM). A demonstration of the potential of this technique in determining stress distribution at a micron level resolution across the interface of an Al_2O_3 coated Si_3N_4 has been described in considerable detail. Study of the CL spectra of the specimen in SEM has the possibility of giving a better spatial (few hundreds of a nanometer) resolution. A previous knowledge (calibration curve) of the stress dependence of the shift of the frequency of CL spectra of a substance must be known beforehand. The way to get such a calibration curve is also discussed in this chapter. Once the necessary procedures are followed, the technique can determine stress field distribution at nanometer length scale around a, say crack tip or interface between two different ceramic/inorganic materials.

The other three chapters (1, 3 and 5) discuss the recent developments in some of the conventional characterization tools: Raman spectroscopy (chapter 1), ion beam characterization (chapter 3) and X-ray spectroscopy with diamond anvil cell (chapter 5). The chapter on Raman spectroscopy emphasizes the theoretical predictions of phonon confinement in nanoparticles, and its manifestations in Raman spectra. Similar to Raman spectroscopy, characterization of materials through interaction of energetic particles (chapter 3) is also a very well-established area. Major part of this chapter deals with the essential concepts involved with the various aspects of this broad field of characterization, such as Rutherford back scattering, elastic recoil detection analysis, nuclear reaction analysis, etc. Most of the comprehensive standard volumes on materials characterization (for example the *ASM Handbook*, and volumes edited by Kaugmann, mentioned above) do justice with this topic. The recent advances in this field are mentioned very briefly in three pages in a section on 'Analysis with Focussed Beams'. The last chapter (chapter 5) highlights in brief the developments in techniques related to X-ray spectroscopy using high energy synchrotron X-ray radiation in conjunction with diamond anvil cell. This chapter is qualitatively different from the rest of the four chapters in the sense that the various spectroscopic techniques discussed in this chapter are used for detailed study of electronic and magnetic structures, and different types of elementary excitations in condensed matter. Such studies are primarily of interest to hard core condensed matter physicists. The chapter highlights that the novelty of the spectroscopic techniques exploits the novel features associated with the third generation synchrotron X-rays and developments at the instrumentation front (e.g. tight focusing of X-ray beam, high resolution detectors). Many of the techniques mentioned in the chapter are simply touched upon in a cursory manner, presumably with the intention to (at least) inform the reader of the scope of the technique. It may be remarked that to do justice with such a wide-ranging topic would require at least a book of similar size. Readers will have to consult book chapters and reviews elsewhere to obtain detailed information about the basic concepts of the different techniques mentioned in this chapter. The bibliography given in the end can be helpful in this regard.

On the whole, the book will be useful to researchers in the materials community, and the effort to bring out such a series is laudable.

RAJEEV RANJAN

Department of Materials Engineering,
Indian Institute of Science,
Bangalore 560 012, India
e-mail: rajeev@materials.iisc.ernet.in