

Preface

On the Surface

I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.

(Sir Isaac Newton, 1642–1727)

When we look at the advancement of science and scientific knowledge, it is in many cases coupled with the advancement of experimental techniques. This is true for instance in astronomy, where the introduction of telescopes allowed the exploration of space, but it is similarly true at small scales, where for instance the introduction of optical microscopes revolutionized biomedicine and made the discovery of bacteria possible with impacts on diagnostics and medical treatments. Today's modern technologies and in particular nanotechnology would not be possible without all the nice instruments and tools, which even allow the imaging of single molecules and atoms at nanoscale. Therefore it is essential for the researcher to keep track of new developments and to know the possibilities – and limitations – of modern analytical techniques.

Surfaces and interfaces of polymers play an important role, both for basic materials science as well as for the design and development of applications. If one reflects more closely about it, nearly all aspects of polymer research and application are directly or indirectly connected with surface and interface phenomena. So polymers are in large quantities applied as coatings and thin films, where of course the appearance, durability and stability depends on the surface and interface properties. But similarly bulk applications require smooth, coloured or scratch resistant surfaces, to name only some of the surface properties, and also the properties in the bulk like toughness or impact resistance of polymers are connected with defect, void or crack formation, which involves internal interfaces. Many polymer

applications involve blends, copolymers and additives, where again morphologies and interfacial aspects strongly influence materials properties. The detailed analysis of surfaces and interfaces therefore turns out to be essential for materials development and optimization, while on the other hand in most cases this analysis is not easy to perform and involves dedicated techniques. It is the purpose of this book to introduce surface and interface analysis techniques including recent developments and to provide a first help in the choice of the technique – or in most cases in the choice of the combination of techniques – which may serve for the solution of a particular problem. It is on the other hand not possible to cover the techniques in great detail and references for further reading are given. Similarly it is not possible to cover all techniques available, and we therefore have chosen a survey of techniques which we believe are the most important and commonly used ones. We also have chosen some examples and application areas, where surfaces and interfaces play an important role and which illustrate their importance.

The book is based on a course for students, researchers and technicians, which we have been offering regularly at our institute in Dresden since 2003. The course contains also experimental and lab presentations, which are very helpful for a better understanding of the possibilities of the techniques. It also is modified and improved every time with a changing team of experts. The book contains a more detailed presentation of surface and interface analysis techniques and provides in particular also useful hints for further reading. We hope that it will help many researchers in solving their problems in this challenging field.

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