

Preface to the First Edition

Life functions depend on chemical communication. It will take decades before man-made systems can approach the regulation complexity of living cells. Only in recent years have scientists started to develop artificial systems that mimic biological functions, and can furthermore interact with living organisms in an intelligent manner. Smart chemical systems that can respond to external signals and can adapt to their environment are based on very different, often soft, materials. These encompass most frequently gels in large or nanoscale dimensions in the form of films, brushes, capsules, vesicles, or membranes. All of these can exhibit swelling or shrinking in response to external signals. Other smart materials are based on gelators, which exhibit solubility changes or a sol-gel phase transition in response to different chemical components. An important extension is particles such as silica microspheres with pores, which can open or close in response to their environment. All these materials can be designed to respond selectively to a chemical input, which can range from changes of pH, of redox conditions, of light and of specific substances. In this book, the first attempt is made to illustrate the development of smart materials, which, unlike those described in related monographs, are not primarily responsive to physical signals such as electric or magnetic fields, but to the chemical environment.

The possible applications of chemically responsive materials span from artificial muscles, actuators for process control, molecular machines, tissue engineering, self-healing surfaces, electronics, to targeted drug delivery. The large variety of different smart materials and the many possible applications would make it difficult to systematically put them together in a single-authored book. The chapters of the present monograph illustrate, on the basis of different chemically-stimulated materials, their great promise. Each chapter was written by experts in their field; the editor is most grateful to all

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of them for their indefatigable cooperation, but takes responsibility for possible shortcomings. The indispensable support by the staff of the RSC is also gratefully acknowledged. It is hoped that the book will stimulate experienced and young scientists to explore the intriguing and virtually endless possibilities of smart materials for applications in many new technologies, and particularly in biomedical fields.

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