Physics of finely divided matter

A. R. Khokhlov

Usp. Fiz. Nauk **151**, 380–381 (February 1987)

Physics of Finely Divided Matter/Eds. N. Boccara and M. Daoud, Springer-Verlag, Berlin; Heidelberg; New York; Tokyo (1985) pp. 365 (Proceedings in Physics, V. 5).

The publishers Springer-Verlag are publishing a series of books on physics "Springer Proceedings in Physics" in which are published proceedings of international conferences and schools on the most active subjects. According to the aims of the publishers this form of publication of proceedings of conferences is preferable than the use for this purpose of the usual scientific journals, since due to the fact that the editors receive papers that are ready for reproduction the time delay and the costs of publication are reduced; on the other hand the proceedings of the conferences are unified into a single series which simplifies citing them, acquisition of them by scientific libraries, etc.

The fifth volume of this series contains the proceedings of the school "Physics of Finely Divided Matter" which took place at Les Houches (France) in March–April 1985. At this school reports were presented in fields which in recent years have been developing very rapidly and successfully— the physics of gels (mainly—polymer gels), the physics of microemulsions and the physics of microsimple media. The bringing together of these fields at first glance distant from each other is connected with the fact that their theoretical description is realized from similar starting points—the utilization of concepts of scaling regularities, fractal structures, the ideas of percolation theory (flowing through, seepage) and the theory of diffusion-controlled aggregation.

The papers contained in the book have been divided into nine sections. The section "Intoduction to the Science of Chemical and Physical Gels" contains initial information on the properties of the best-known gels: covalently bonded polymer nets, weakly-bonded "physical" or "thermally reversible" gels of biological (gelatin, pectin) and geological (clays) origin, materials with fractal structure, obtained as a result of processes of random growth. The next section discusses theoretical concepts and basic experimental facts concerning the structure of microemulsions of immiscible liquids, stabilized by surface-active substances (in particular, the practically important question of microemulsions of petroleum and water). The third section of the book is devoted to geometrical problems arising in connection with the study of structure of microporous media. The fourth section contains papers on percolation theory and the application of this theory to problems of the physics of gel formation and the physics of conductivity of inhomogeneous media. In the fifth section the properties of branched polymers and already formed polymer nets are discussed from similar points of view. The subsequent sections are devoted to the theory of elastic and dielectric properties of percolation systems, to the kinetics of diffusion-controlled aggregation, to the problem of diffusion and flow in porous media, the theory of wetting, etc.

The totality of all the articles in this collection, many of which have been written by leading scientists, gives quite a complete idea of the present state of these important problems. Many articles can also be regarded as an authoritative introduction to the field. Therefore the book under review undoubtedly will be very useful not only to specialists but also to readers who are only beginning their acquaintance with this set of problems. This is particularly important since lately many physicists who previously worked in traditional fields are now paying ever more attention to new physical objects—including those which are discussed in detail in the present book.

Translated by G. M. Volkoff