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Nota di contenuto	Cover; Contents; Preface; 1 Introduction; 1.1 Gels from colloidal and polymer networks: a brief survey; 1.2 Structural characteristics and their study; 1.2.1 Solids versus liquids; 1.2.2 Multidisciplinary nature of gel studies; 1.3 Non-physical gels; 1.3.1 Chemical gels; 1.3.2 Hybrid organic-inorganic materials; 1.3.3 Inorganic gels; 1.4 Physical gels; 1.5 Outline of the book; Chapter 2 Techniques for the characterization of physical gels; Chapter 3 The sol-gel transition; Chapter 4 General properties of polymer networks; Chapter 5 Ionic gels; Chapter 6 Hydrophobically associated networks Chapter 7 Helical structures from neutral biopolymersChapter 8 Gelation through phase transformation in synthetic and natural polymers; Chapter 9 Colloidal gels from proteins and peptides; Chapter 10 Mixed gels; Chapter 11 Innovative systems and applications;

References; 2 Techniques for the characterization of physical gels; 2.1 Introduction; 2.2 Scattering techniques; 2.2.1 Principles of scattering; 2.2.2 Scattering by a single particle; 2.2.3 Effect of particle concentration; 2.2.4 Polymer solutions; 2.3 Calorimetric studies; 2.3.1 Basic concepts; 2.3.2 Differential scanning calorimetry (DSC); 2.3.3 Microcalorimetry: DSC; 2.3.4 Isothermal titration calorimetry (ITC); 2.4 Microscopy of gel networks; 2.4.1 Transmission electron microscopy (TEM); 2.4.2 Atomic force microscopy (AFM); 2.5 Rheological characterization; 2.5.1 Small-deformation measurements; 2.5.1.1 Small-deformation oscillatory shear methods; 2.5.1.2 Controlled strain versus controlled stress; 2.5.1.3 Frequency and strain dependence; Polymer solutions; Polymer gels; 2.5.1.4 Creep and stress relaxation; 2.5.1.5 Temperature dependence; 2.5.1.6 Time-dependent systems; The kinetic gelation experiment; Gelation time measurement; 2.5.1.7 Range of viscoelastic linearity; 2.5.1.8 Failure of the Cox-Merz rule; 2.5.2 Large-deformation measurements; 2.6 Role of numerical simulations; 2.6.1 Fractal dimensions; 2.6.2 Gelling or non-gelling systems?; 2.6.3 Improvements of the interaction potentials; 2.7 Conclusions; References; 3 The sol-gel transition; 3.1 Flory-Stockmayer ('classical') theory; 3.2 Percolation model; 3.3 Percolation and phase transitions; 3.3.1 Extent of the critical domain; 3.4 Percolation and gelation; 3.4.1 Winter-Chambon criteria; 3.5 Experimental investigations of gelation transitions; 3.5.1 Percolation exponents; 3.5.2 Experimental determination by the Winter-Chambon criteria; 3.8 Zipper model; 3.9 Liquid crystal gels; 3.10 Conclusions; References; 4 General properties of polymer networks; 4.1 Chemically cross-linked networks and gels; 4.1.1 Non-linear materials formed from the reaction of functional groups; 4.1.2 Non-linear materials from preformed polymer chains; 4.1.3 Poly(acrylamide) and poly(NIPAM) gels; 4.1.4 Copolymer networks; 4.2 Theories of rubber elasticity; 4.2.1 Reel chain models; 4.3 Swelling of gels; 4.3.1 Discontinuous swelling

## Sommario/riassunto

Presenting a unique perspective on state-of-the-art physical gels, this interdisciplinary guide provides a complete, critical analysis of the field and highlights recent developments. It shows the interconnections between the key aspects of gels, from molecules and structure through to rheological and functional properties, with each chapter focusing on a different class of gel. There is also a final chapter covering innovative systems and applications, providing the information needed to understand current and future practical applications of gels in the pharmaceutical, agricultural, cosmetic, chemical and food industries. Many research teams are involved in the field of gels, including theoreticians, experimentalists and chemical engineers, but this interdisciplinary book collates and rationalises the many different points of view to provide a clear understanding of these complex systems for researchers and graduate students.