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Block Copolymers

LUDWIK LEIBLER, Matière Molle et Chimie, UMR 7167 CNRS/ESPCI, ESPCI, 10 rue Vauquelin, 75005 PARIS, France

In 1969 (Rep. Prog. Phys. 32, 187(1969)) de Gennes proposed a simple way to understand and describe mesophase organization of block copolymers in what we now call the strong segregation limit. The following year he showed how self-consistent methods due to Edwards can be applied to understand subtle correlation effects in polymer melts (J. Physique 31, 235(1970)) and established theoretical framework for quantitative interpretation of scattering experiments and of what we call now weak segregation regime of block copolymers. This was the basis of the theory of order-disorder transition in multiblock copolymers that he published in 1980 (Faraday Transactions). In this pioneering work he also discussed the role of blocks' polydispersity. Eventually, as early as in 1977 de Gennes realized that block copolymers "are most promising systems for deeper understanding of lyophilic phase diagrams" (in Suppl. Solid State Phys Ed. Ehrenreich 1977) and this vision led not only to some very interesting theories of block copolymer solutions, but also to some very quantitative model of membranes and interfaces elasticity and to a very influential theory of microemulsions (J. Phys. Chem. 86, 2294(1982)). Since 1980 tens of thousands of papers dealing with block copolymers were published, but it should be stressed that in seventies it has been a very unknown area. Clearly de Gennes' visionary interest in block copolymers had, and has, a tremendous impact in the field. I will illustrate using several examples from very different areas how de Gennes' deep understanding of block copolymers and the theoretical methods he introduced influenced both theory and experiments and I will also show how they are relevant for many present and future industrial applications.