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Advances in Polymer Science

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Preface

In polymer crystallization the challenge is to identify and clarify the transformations by which chain molecules pass from a disordered, molten state to the ordered supra-molecular organization known as the semi-crystalline state. The subject is highly relevant in terms of both basic science and technology; it is indeed clear that many modern applications require complete control of the structure and the morphology of polymers from macroscopic dimensions down to below the nanoscale. As a simple example, making the crystallites in a polymer fiber equally oriented and reducing the number of chain folds (or hairpins) therein, usually turn out to be very favorable requisites for mechanical performance.

Is the onset of polymer crystallization, at least in some instances, preceded or accompanied by partial ordering of the system, possibly with influence on the kinetics and the equilibrium at both the molecular and the supra-molecular level? We may look at this issue, addressed in the present collection of contributions to *Advances in Polymer Science*, from very different sides. Modern microscopic techniques enable us to explore localized morphological aspects down to the observation of individual molecules, whereas X-ray, neutron and electron scattering provide molecular structure information down to the atomistic level. Experimental techniques allow us to explore kinetic aspects and are paralleled nowadays by fast-expanding molecular simulation approaches, increasingly able to give clues to the many open problems relating to structure development and morphology. Besides, the statistical-mechanical viewpoint may help to make sense out of the many experimental results and related simulations.

While in volumes 180 and 181 of this series several basic aspects of morphology, inter-phase structure and disorder were addressed, in the present volume, molecular interactions, modeling, phase transformation and crystallization kinetics are considered (see the subject index including keywords from volumes 180 and 181 at the end of the book). Needless to say, in spite of substantial success over 60 years or more we are still far from having a complete and unambiguous picture of polymer crystallization. We firmly believe that a fruitful approach to such a complex problem requires one to give way to many different and sometimes conflicting viewpoints, as we have attempted to do in these volumes. We do hope that they are not only a time-capsule left for

future scientists, but that they also contain the seeds of a coherent view that will eventually develop.

I would like to renew my gratitude to Valdo Meille for his very creative, intelligent and active co-operation.

Milan, October 2005 *Giuseppe Allegra*

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