STRUCTURE DEVELOPMENT IN POLYMER PROCESSING

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Abstract - Deep understanding of the mechanism of structure development in polymer processing is indispensable for the improvement of the properties of final products through the designing of materials and processes. Melt spinning and drawing processes are probably the most fundamental procedures of polymer processing. These processes are useful for the understanding of the characteristic behavior of various types of polymers because of the uniaxial-nature of both the process and the developed structure. In-situ measurements of process parameters and structure development in the melt spinning and drawing processes are also an effective way for the clarification of the polymer behavior. Utilization of the steady-state process and conversion between Eulerian and Lagrangean coordinates enables us to obtain the information with high time-resolution. It should be noted that the crystallization of polymers under the effect of stress proceeds much faster than that in the quiescent state. Sequential and simultaneous biaxial stretching of films are other continuous industrial processes in which three-dimensional analyses of the structure is necessary. On the other hand, processes such as blow molding and injection molding are the so-called batch-type process in which analyses of not only the structural hierarchy but also structural variation in the products are important. In terms of the theoretical analyses on the mechanism of structure development, stress-optical rule for the molecular orientation, and non-isothermal crystallization kinetics under the effect of flow have been the two main subjects, however, effect of the molecular entanglement on structure development attracts much attention these days. Collaboration of people in the fields of rheology and structure development seems to be required in this field. These subjects will be discussed consulting numerous publications by Prof. James L. White.