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Visualization Analyses of Injection Molding Phenomena inside Mold and Heating Cylinder

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Visualization techniques, irrespective of dynamic and static approaches, have been playing a quite important role in advancing experimental analyses of molding phenomena in the field of polymer processing. For the past twenty years, the author's collaborative research group with industries has been dedicated to the systematic visualization analyses of injection molding phenomena from the hopper-throat of injection molding machine to the end of mold cavity. Many kinds of original and specific visualization tools were step by step developed in each project and applied to the experimental analysis; e.g. glass-inserted mold and heating cylinder, runner exchange system, automatically tracking unit in combination with a high-speed-video camera system, etc.

In this lecture, the author reviews the advancement of visualization techniques, focusing on the topics for recent twenty years, and introduces the fruitful results in addition to the demonstration of beautiful VTR images observed through the original tools. The contents to be introduced in the lecture are exemplified as follows;

(1) Visualization inside heating cylinder; solid conveying process, starve-feeding process, continuous plastication process, reciprocating plastication process, solid-bed break-up process, stagnation phenomena inside screw-channel, melt behavior inside reservoir etc.

(2) Visualization inside mold; melt behavior inside sprue, runner imbalancing at multi-cavities system, injected-melt behavior near the gate, weld-line generation process, silver-streak generation process, flow-mark generation process, burn-mark generation process, asymmetrical fountain flow, zigzag fountain flow, side-edge flow, step-change flow, solidification process, ultra-high-speed filling process, inertia flow, transcription process at fine prism patterns, gas-venting process, demolding process etc.