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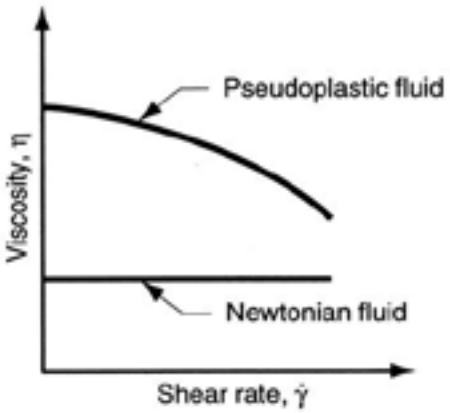
Influence of non-Newtonian behavior of polymers on their processing characteristics

During the manufacture of polymeric (or plastic) materials, polymers are subjected to flow. The way these liquids react is determined by the shapes, or configurations that the molecules adopt. Polymer molecules behave like springs, and become stretched by the flow, giving rise to the strongly elastic behavior of polymeric fluids. The study of the dynamics of polymer molecules is very important for the understanding of flow of polymeric fluids. The unique properties of polymers are often not apparent until they are encountered by chemical engineers on the job. The unique qualities of polymers most evident in their processing, the fabrication of bulk polymer (resin) into a finished article, which typically requires an entirely different equipment than that required to process conventional liquids. What makes polymeric materials interesting in this context is the fact that their time constants for flow are of the same order of magnitude as their processing times for extrusion, injection molding and blow molding. In very short processing times, the polymer may behave as a solid, while in long processing times the material may behave as a fluid. This dual nature (fluid-solid) is referred to as viscoelastic behavior. Elastic stresses in polymeric and other complex fluids can give rise to strange flow behavior not seen in Newtonian fluids. This can for example, produce undesirable instabilities in industrial processes. Interfacial instability in co-extrusion leads to defects consisting of highly irregular or sometimes regular waviness which appears in coextruded structures at the polymer/polymer interface. The effect is to significantly reduce the optical quality of coextruded film. It is an internal defect, which distinguishes it from sharkskin, which is a surface defect. In this presentation we will discuss how the non-Newtonian behavior affects processing of polymers, using examples.



Biography

Mosongo Moukwa is a senior level management professional and entrepreneur recognized for his achievements to helping companies improve their profitability by commercializing new technologies and developing new markets. His was Vice President of Global Technology at Johnson Polymer, WI, now part of BASF, Vice President of Global Technology at Reichhold, NC, and Vice President of Technology at Asian Paints, India. He is now Director of Technology at PolyOne Designed Structures and Solution LLC, based in Saint Louis, MO. He holds a PhD from the Universite de Sherbrooke, Quebec, Canada and was a NSERC postdoctoral fellow at Northwestern University, IL.

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