

INVITED LECTURE – JOHN VLACHOPOULOS



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Romancing the Rheological Design of Extrusion Dies

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Extrusion dies are used for the production of film, sheet, profiles, tubing and pipes, wire and cable coating and other products. The first requirement of extrusion die design is balancing of the flow, which means same local area-average velocity at the die exit. Other problems relate to local wall shear rates and stresses, residence times, temperature rise due by viscous dissipation, regions of stagnating flow and the rheological behavior of polymer melts. Despite the recent advances in numerical methods and rheology, trial and error procedures continue to be used by many designers and manufacturers throughout the world. When computer flow simulation packages are employed they seldom go beyond the generalized Newtonian fluid for the description of material behavior. Inverse methods, which have been developed by some researchers, had little, if any, impact on extrusion die design. The reasons for this unsatisfactory state of the technology, as well as ways to improve it, will be discussed. Several examples will be presented illustrating how rational approaches in extrusion die design and optimization can be implemented on the factory floor by using computer flow simulation software and rheological characterization of polymer melts.
