

Chemical Engineering Graduate Seminar

THE TEXAS DISTINGUISHED FACULTY LECTURE SERIES

Presents:

Dr. Morton M. Denn

The City University of New York



3:30 – 4:30 PM

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CPE 2.218

“Rupture of Entangled Polymers in Elongational Flow”

Entangled polymer melts and concentrated solutions fail in several different modes in elongational flow. Rupture, which appears to be a cohesive failure that is qualitatively different from failure accompanied by necking, generally occurs at high relative elongation rates and small strains, where a substantial part of the deformation is recoverable. Reiner and Freudenthal proposed a dynamical theory of the strength of liquids in 1938, but the predictions are not consistent with experiments on entangled polymers; little has been done since, and a comprehensive understanding of rupture in polymer melts is still lacking. We have developed a simple scaling analysis that predicts rupture at a critical stress in the polymer network, corresponding to a critical value of the recoverable strain. This simple picture, combined with an analysis of recovery following elongational deformation, predicts the correct rupture behavior for melts with a narrow molecular weight distribution, but a more fundamental analysis is needed.