OP-Carreau-852

Wednsday, May 11, 2011, 04:40-05:00 pm
Room: Karam 4

MODELING OF FREE-WITHDRAWAL COATING WITH UV-CURING TIO2 FILLED RESINS

Andrew Hrymak [1], Mahyar Javidid[1] , Michael Pope [2]
[1]University of Western Ontario , [2]Princeton University
ahrymak@uwo.ca

A mathematical model for free withdrawal coating of particle suspensions has been developed for capturing thickness preductions necessary for highly reproducible coatings. An FDA approved resin for applications involving medical devices, known as, Dymax 1186-MT, was used as a matrix to suspend high refractive index titanium dioxide particles. A suspension containing 1vol% TiO2 was used to coat 100m diameter fiber optic diffusers using the free withdrawal coating process. The coating thickness was found to vary significantly between suspensions containing different grades of TiO2. These TiO2 grades differ in terms of their surface treatment, mean particle diameter and dispersibility in the polymer resin studied. The rheological properties and surface tension of these suspensions were analyzed and input as parameters into both the Newtonian and power-law models of free withdrawalcoating, previously described in the literature, in order to assess the predicted effect of changes in bulk fluid properties on coating thickness. The predicted coating thickness, based on slight differences in suspension rheology and surface tension, did not correspond to the coating thicknesses determined experimentally. This indicated that differences in bulk fluid properties cannot explain the observed coating differences and that other factors such as particle-particle and particle-fluid interactions may be responsible for the observed differences in coating thickness. In order to more accurately predict the coating thickness, coating theory was developed using the Ellis model constitutive equation.