14th International Coating Science and Technology Symposium

# Dynamics of Coating Flows with Chemical Reaction

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Presented at the 14th International Coating Science and Technology Symposium,
September 7-10, 2008, Marina del Rey, California[1]

**Abstract:**

In this presentation we consider a class of coating flows in which coating properties can be altered by initiating suitable chemical reactions within the coating film. In particular, we consider isothermal photochemical reactions initiated by exposing the coating film to UV irradiation. Photochemical reactions are of scientific and technical interest because of the possibility of controlling spatiotemporal pattern formation in a thin film by modulating the light intensity. What is uncertain, however, is whether the distribution of chemical species during the photochemical reaction can drive Marangoni convection within the thin film, resulting in unwanted imperfections in the desired pattern. We consider a photopolymerization reaction that follows a free - radical mechanism. The free radicals are produced by a photoinitiator that dissociates when exposed to the UV irradiation. The absorbed light intensity is given by a Beer-Lambert law. We make use of the lubrication approximation to derive an evolution equation for the thin film during reaction. We take the surface tension to be a function of the reactant and product concentrations and consider a long-wave deformation mode of the Marangoni convection. The viscosity of the liquid is taken to be a function of the extent of reaction. The species balances and the evolution equation for the film thickness are solved numerically. Results are presented when the monomer is n-butyl acrylate. We show that an instability can be induced in the reacting film for certain ratios of diffusivities and film thicknesses.

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