

## Experimental and Theoretical Studies in Interfacial Polycondensation

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### Abstract

Interfacial polycondensation (IP) has been studied for many applications such as bulk polymer synthesis, micro/nano-encapsulation, thin film composite membrane preparation, polymer nanocomposite synthesis, fiber surface modification, micro-unit operations, self healing materials, etc. IP offers the possibility of rapid production of polymer film, which is insoluble in both phases, with high and specific molecular weight ranges under normal conditions of temperature and pressure at/or near the interface of two immiscible phases. The performance of this film depends upon its chemical composition and properties such as thickness, crystallinity, molecular weight, degree of crosslinking, mechanical and thermal properties etc. A systematic study of how membrane properties vary with preparation conditions will therefore be important for the rational design of process equipment and conditions for particular applications. Modeling of film formation by IP and prediction of film properties involves consideration of a complex array of interactions among several rate processes, and is rendered further difficulty by the need to unequivocally determine the values of the physicochemical parameters that arise. This need and challenge form the motivation for our ***Experimental and theoretical studies in interfacial polycondensation***. Polyurea microcapsule formation through diisocyanate route is the model system chosen for experimental studies because of reaction simplicity. Various characterization techniques such as FTIR, XRD, TG-DSC, GPC, SEM, TEM, contact angle goniometer, surface tensiometer, viscometry, dynamic light scattering, etc. are used to get more details of the system. The IP reaction model is developed by considering all mechanistic aspects along with the polymer thermodynamics and diffusion reaction mechanism. It is believed that our fundamental research will provide sound information for further development of both the theory and practice of IP. Based on the insights gained from the microcapsule work, we have initiated experimental studies in two other areas: polyurea nanocapsule formation and thin film composite membranes.

**Keywords:** Interfacial polycondensation kinetics, modeling, microcapsule, nanocapsule, thin film composite membrane