Monitoring of the Formation of Polymeric Films by Photothermal Techniques

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Evaporation is a widely used technique for developing polymeric films. In this work, the analysis of the formation of a film on top of a substrate is investigated using photothermal techniques. The configuration involves the illumination of an opaque substrate with a modulated laser and a detection of the heating in the illuminated zone. The system studied is a two layer system in which the non-illuminated layer presents a dynamic behavior, whose thickness and physical properties change as a function of time. Results on the modeling of these systems depending on evaporation rates, concentration changes, diffusion, polymeric chain entanglements, and interactions are presented. It is shown that the process in which evaporation is the dominant contribution, a stable long lasting process, is observed, and at a certain time a sudden change in the amplitude of the photothermal signal occurs. On the other hand, the additional contributions, such as increases in concentration, interactions, and entanglements of the polymeric chains, involve processes that make the amplitude of the photothermal signal grow smoothly with time. Our results are compared to experimental results obtained for pure evaporation and for the formation of films of biopolymers and adhesives. The contribution of the different mechanisms involved during the film formation is discussed.