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Sprayed Polymer Films from Aqueous Poly(vinyl alcohol) Solutions

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The aim of this paper is to report the possibility of the spraying process to form a strong film with the investigation of the structure and physical properties of the sprayed poly(vinyl alcohol) films. For the comparison the study was carried out with the solution cast PVA films.

The aqueous PVA solutions were sprayed with a compressed air. The air was supplied from an air-cooled piston compressor (power:2.2kw, working pressure:7.5 kgf/cm^2).

The aqueous PVA solutions were transparent. The 5, 10, and 15 wt% aqueous solutions formed gels at room temperature after different gelation times. The overlap concentration C^* for the PVA aqueous solution system was calculated to be 1.3 wt% by following the method of Kaji et al[5]. So the PVA chains in 1 wt% water solution was in a dilute regime.

Spray application doesn't have to be a secondary process such as for coatings. It can be a primary process for producing polymer films. In this work polymer film with high dimensional stability was prepared with 5 wt% PVA aqueous solution.

Sprayed PVA films were semicrystalline. The crystallinity was about 1/3. The structure of the sprayed film was developed by continuous sticking of agglomerates of precipitates on drying. If solution being

sprayed is dilute the film was composed of stacked particles. With increasing polymer concentration of the feeding solution, structure of film changed to continuous and homogeneous one. By step-by-step stacking of the precipitates the continuous and coherent PVA films were formed successfully. Thus spraying is a good polymer processing method adequate for self-supporting film formation.

The conclusions are as follows:

1. We obtained PVA films by spraying PVA aqueous solutions.

2. The structure of the sprayed film was developed by the step-by-step stacking of precipitates.

3. With increasing polymer concentration in the feeding solution, the structure of the film changed from the stacked-precipitates to a continuous one.

4. The sprayed PVA films were semicrystalline (crystallinity 0.38).

5. The sprayed PVA films were tough enough to be drawn.

6. The spray-drying of polymer solution is an adequate method reducing the entanglement density.