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Fundamental Studies on the Acrylic Copolymer Emulsions

Kanehiro KATO*

The fundamental and practical properties of the ethyl acrylate-methyl methacrylate copolymer emulsions were investigated. The polymerization was carried out by using $(\text{NH}_4)_2\text{S}_2\text{O}_8$ as an initiator, and the anionic emulsifier.

Concentrations of the emulsifier gave large effects upon the intrinsic viscosity $[\eta]$ of the copolymers, the average particle size (μ) and the surface tension (γ) of the copolymer emulsions. It was found that the relations between the critical micelle concentration (C. M. C.) and the particle size or the surface tension were important. Above the C. M. C., the particle size remained a constant value (0.1μ). At the C. M. C. the surface tension reached a maximum value. The $[\eta]$ increased with an increase in the emulsifier concentration. In the experiments, the maximum value of $[\eta]$ was 3.0.

The methyl methacrylate content in copolymers had important influence on the minimum film formation temperature (MFT). In the case of EA/MMA=7/3, the MFT was below 0°C . For EA/MMA=5/5 and EA/MMA=3/7, the MFT was 30°C and 70°C , respectively. The relationship between the MFT and the composition of copolymer was linear. The value of $[\eta]$ was maximum at the monomer concentration of 35%, below which the relation between $[\text{M}]$ and $[\eta]$ agreed with that of Smith and Ewart. Above 35%, the $[\eta]$ was decreased owing to the rise of temperature of reaction system by the heat of polymerization.

There are Frenkel's and Brown's theory for the mechanism of film formation from emulsions. In order to confirm the above theories, the following experiments were done. The filter papers were treated with the emulsions. Then, the wet papers were heat-treated under two different conditions i.e., (I) the wet papers were dried at various temperature, and (II) the wet papers were dried below the MFT and followed by heat-treatment at various temperature.

The results of this experiment showed that the Frenkel's theory could be applied when the particles were plastic, while the Brown's theory was established in the case of less plastic particles.

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