

Thermoreversible Gelation of Polyvinylidene fluoride in γ -butyrolactone Solution

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Thermoreversible physical gels constitute three-dimensional networks whose junction points consists of physical bonds. Physical gelation of polymer solution is generally regarded to arise from a hydrogen bonding type association of the polymer chains, crystalline formation of the polymer chains and liquid-liquid phase separation by spinodal decomposition. In the physical gels of crystalline polymers, it has been recently suggested that crystallization is not a necessary condition for gelation. However cystalization follows necessarily gelation in the gels prepared from the solutions of crystalline polymers. Whether crystallization occurs in solution before gelation or in the gel phase after gelation may be solved by investigating gels prepared from the crystalline polymers having polymorphism. Polyvinylidene fluoride (PVDF) which is a piezoelectric polymer has at least four crystal structures. Therefore PVDF may be a good candidate for understanding the gelation mechanism of the crystalline polymers. Yet no report on its gelation behavior has been made.

In this study, the gelation mechanism is discussed in the gels prepared from PVDF/ γ -butyrolactone solution.

The following conclusions can be obtained from the various measurements such as gelation time, gel melting point, sol-gel transition temperature, x-ray diffraction and SEM. Gelation of PVDF occurs above the critical concentration of 4.5 g/100 ml in γ -butyrolactone solution. The gelation is caused from liquid-liquid phase separation even if the crystallization follows gelation in the late stage. It is evidenced by the formation of transparent gels, a relatively small enthalpy of gel formation and existence of two types crystal structures.