

Prepolymerization Reaction Kinetics of Acrolein-pentaerythritol Resin by Online IR Technology

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Abstract: The reaction kinetic parameters have an important guiding significance for the prepolymerization of acrolein-pentaerythritol resin. Online IR method was used to study the prepolymerization reaction kinetics of acrolein-pentaerythritol resin. When the reaction temperature was 338.15, 348.15 K and 358.15 K, and the dosage of diethyl sulfate(DES) as catalyst was 2% and 4% respectively, by monitoring the change in concentration of functional group =CH_2 in the reaction system, the kinetic equation of the polymerization reaction was obtained by calculation and the mechanical property of cured product was studied. The results show that the reaction is a second-order reaction, but the apparent reaction rate and reaction activation energy in the early stage and late stage for the reaction have a large difference. When the dosage of DES is 2%, the apparent activation energy in the early stage and late stage of the reaction is $36.5 \text{ kJ} \cdot \text{mol}^{-1}$ and $49.6 \text{ kJ} \cdot \text{mol}^{-1}$ respectively. When the dosage of DES is 4%, the apparent activation energy in the early stage and late stage of the reaction is $61.0 \text{ kJ} \cdot \text{mol}^{-1}$ and $69.1 \text{ kJ} \cdot \text{mol}^{-1}$ respectively. When the dosage of DES is 2% and 4%, the effect of dosage of DES on the mechanical property of cured product is not obvious. The reaction temperature on the mechanical property of cured product has a remarkable influence, when the dosage of DES is 2% and 4%, the maximum tensile strength appeared at 338.15 K is 41.99 MPa and 41.17 MPa, respectively, the maximum elongation at break appeared at 358.15 K is 8.47% and 7.27%, respectively.

Key words: online IR technology; acrolein-pentaerythritol resin; reaction kinetics; mechanical property

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