E2-32 A novel approach to study kinetics of polymerization or curing of polymers by using differential scanning calorimetry isothermal kinetics

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Polyurethane (PUR) formation kinetics were studied by using a novel kinetic approach. Differential scanning calorimetry was used to study kinetics of polymerisation.

Polyurethanes were formed by using Polycaprolactone diol (MW - 1000) (PCL) and 4,4' phenylmethane diisocyanate (MDI) as 2 monomers. In this new method, the heat flow rate (dH/dt) was directly used as the measurement in kinetic studies instead of cumulative area in the conventional method. Hence, the problem of lost area and the estimation of lost area by extrapolation can be overcome. A new model was derived from second order kinetic theory to obtain parameters such as rate constant, conversions etc.

The rate constant values were obtained by plotting $1(dH/dt)^{1/2}$ against t, by using equation:

$$1/(dH/dt)^{1/2} = (k'k)^{1/2}t + (k'/k)^{1/2}(1/C_o)$$

The experiments were carried out in bulk and not in solution. The new kinetic approach was found to be in good agreement with the second order kinetics giving evidence to validity of use of direct dH/dt measurement in kinetic studies.