

Electronic Supplementary Information (ESI)

Kinetics of Interfacial Curing Reaction for an Epoxy-Amine Mixture

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1. Interfacial orientation of 4,4'-diaminodiphenyl sulfone (DDS). Figure S1 shows sum-frequency generation (SFG) spectra for a 4,4'-diaminodiphenyl sulfone (DDS) film sandwiched by quartz substrates. The measurement was conducted at 403 K as a function of time. For clarity, each spectrum has been vertically shifted. A peak observed at 3,370 cm^{-1} was assignable to the symmetric stretching of amino groups (NH_2 s). The peak intensity for NH_2 s did not change with annealing at 403 K. This means that NH_2 groups remained oriented under this condition unless they reacted with epoxy groups.

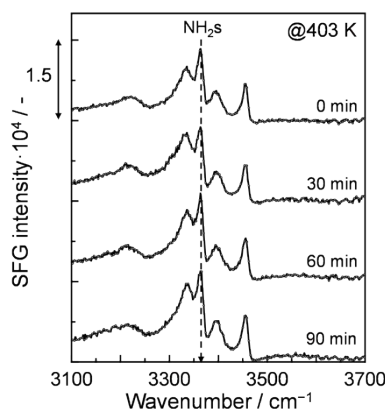


Figure S1. SFG spectra for a DDS film at 403 K as a function of time.

2. Mixing ratio dependence of curing kinetics. Reaction kinetics for epoxy phenol novolac and DDS with different mixing ratios were examined. Fourier transform infrared spectroscopy and SFG spectroscopy were conducted to obtain the apparent reaction rate constant (k) in the bulk and at the outermost interface, respectively. Based on the Arrhenius analysis using eq. (2) in the main text, the activation energy (E_a) and the frequency factor (A) were obtained. Panels (a) and (b) of Figure S2 show mixing ratio dependence of E_a and A , respectively. The E_a value was constant at ca. 57 $\text{kJ}\cdot\text{mol}^{-1}$ in the bulk and at the outermost interface, independent of the mixing ratio.

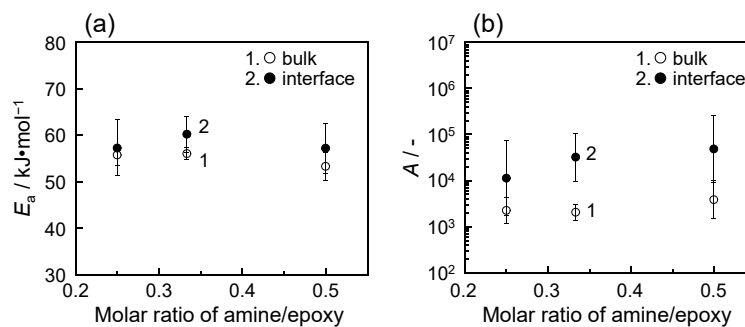


Figure S2. Mixing ratio dependence of (a) E_a and (b) A obtained by Arrhenius analysis.