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Thermal Decomposition Kinetics of Zeolite/Epoxy Composites System by Flynn & Wall Equation

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Flynn & Wall 식에 의한 Zeolite/Epoxy 복합재료의 열분해 속도론

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Zeolites are crystalline aluminosilicate minerals and have large internal surface area due to the channels and pores available for the adsorption of low weight molecules. Therefore, zeolites have been used in many industrial fields as catalysts, molecular sieves, sorptive agents, ion exchange material, etc.

The purpose of this study was to inquire about thermal stability of the zeolite added DGEBA/MDA/NPG system. Thermal decomposition kinetics of diglycidyl ether of bisphenol A(DGEBA)/4,4'-methylene dianiline(MDA)/ neopentyl glycol(NPG) system filled with 5, 10, 15 and 20 phr of natural zeolite were analyzed by thermogravimetry(TG).

In this study, the expression derived by Flynn & Wall was used to investigate the thermal decomposition kinetics.

Flynn & Wall equation is

$$E_{ad} = \frac{-R}{0.457}\left[\frac{d\log\beta}{d(T^{-1})}\right]$$

where, E_{ad} is thermal decomposition activation energy, R is gas constant. β is heating rate and T is the temperature at a selected constant conversion.

Experiment

DGEBA and NPG(10 phr) were well mixed with dried natural zeolite(0, 5, 10, 15 and 20 phr) at 100°C and MDA(30 phr) was added to the mixtures at 80°C. The samples were cured at 150°C for 1 hr after curing at 80°C for 1.5 hr. The weighed sample(5-7 mg) was placed in TG furnace and the weight loss was measured at the heating rates of 5, 10, 15, and 20 °C/min.

Results and Discussion

From the plots of log β and $1/T \times 10^3$, E_{ad} were 95.87, 172.83, 187.38, 204.12 and 211.40 kJ/mol at 20% of weight loss for the system with 0, 5, 10, 15 and 20 phr of NPG content, respectively. These results lead to the conclusion that thermal decomposition activation energy was increased with the increment of zeolite content and this meant that thermal stability increased.