

무기물이 충전된 에폭시수지의 경화반응과 유변학적 거동에 관한 연구

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Cure Kinetics and chemorology of silica filled

DGEBA/Polyoxypropylenediamine epoxy system

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초 록 : silica가 충전된 epoxy system(DGEBA와 Polyoxypropylenediamine)의 경화 반응과정에서의 유변학적인 변화와 반응속도를 연구하였다. 이 연구에서는 silica의 충전량에 따른 epoxy system의 반응 kinetics와 유변학적 거동에 미치는 영향에 중점을 두었다. 충전제의 첨가량은 0 phr에서 200phr까지 변화를 주었다.

silica가 첨가된 epoxy system의 경화거동은 DSC를 이용한 승온적 방법으로 측정하였다. epoxy system의 전환율은 실험하여 얻은 DSC curve를 적분하여 구했고 kinetic parameter는 nonlinear regression method를 이용하여 얻을 수 있었다. DSC 실험 결과 silica가 충전되면 충전되지 않은 epoxy system보다 경화반응이 빨라지며 반응열은 감소함을 볼 수 있었다.

유변학적 거동은 Physica를 이용하여 실험하였고 elastic modulus( $G'$ ), loss modulus( $G''$ )과 loss tangent( $\tan \delta$ )와 viscosity( $\eta$ )를 얻었다. 초기 stage에서 점도는 silica가 첨가됨에 따라 점도는 높아졌고, gel temperature는 감소함을 볼 수 있었다.

본 연구결과 epoxy system에 silica가 첨가됨에 따라 경화 반응이 촉진되는 것을 알 수 있었다.

Abstract : The chemorheological changes and kinetics during curing reaction of an silica filled epoxy system(DGEBA with curing agent Polyoxypropylene diamine) were investigated. This study concentrates on the influence of silica on the reaction kinetics and rheological behavior of the epoxy system. The concentration of the filler was varied 0 ~ 200 phr.

Curing behavior of the silica filled epoxy system was measured at various heating rates with DSC. Conversion was also measured by integrating the obtained DSC curve and Kinetic parameters measured by using the nonlinear regression method. DSC experiments showed that the presence of silica was found to accelerate the progress of the curing reaction and to reduce the heat of reaction compared with that of unfilled epoxy systems.

Rheological experiments were conducted on a Physica by using a disposable parallel plate fixture. Material properties were measured such as the elastic modulus( $G'$ ), the loss modulus( $G''$ ), the loss tangent( $\tan \delta$ ), and the viscosity( $\eta$ ). The more the silica was added the higher the viscosity was at the initial stage, and the more the silica filler was added, and the lower the gel temperature was in the epoxy system.

In this study it is concluded that that the curing of the silica filled epoxy system was found to be accelerated, as silica was added to the epoxy compound.