2.22 Analysis of the hardening process of epoxy adhesive (1) - FTIR

•Explanation

Among polymeric materials there are those whose molecular structure changes over time as they are heated, exposed to light, or mixed. FTIR is an effective method of measurement for tracking these changes. It's advantage is that it can track multiple absorption peaks at the same time. As an example of such a measurement, the measurement of the hardening process of epoxy adhesive is introduced here.

Epoxy adhesive hardens upon mixing of the main ingredient and a hardener, following the process shown in Fig. 2.22.1. This process was measured over a fixed time interval, and the nature of the changes in the functional groups investigated.

•Pretreatment

2 liquid mixture type epoxy adhesive was mixed and then smeared on the KBr aperture plate of a high temperature heating cell. Measurement was carried out at 5 minute intervals over 60 minutes at 80°C.

•Results

From the spectrum in Fig. 2.22.2 it can be seen that there are hardly any changes in the absorption peculiar to the alkyl groups, carbonyl groups, and benzene rings. On the other hand it can be seen that the peaks of the epoxy, amino and hydroxyl groups are gradually changing. In Figs. 2.22.3 and 2.22.4 the peak regions of the epoxy and hydroxyl groups are magnified. Shown in Fig. 2.22.5 are the time course curves of the surface integrals of 3,650 to 3,140cm^{-1} (hydroxyl group) and 925 to 899cm^{-1} (epoxy group). In addition, shown in Fig. 2.22.6 are the time course curves of the epoxy group measured at the cell temperatures of 60°C, 80°C, and 100°C.

•Analytical Conditions

Accessory	:	High temperature cell
Resolution	:	8cm^{-1}
Accumulation	:	1min
Apodization	:	Rectangular
Detector	:	DLATGS

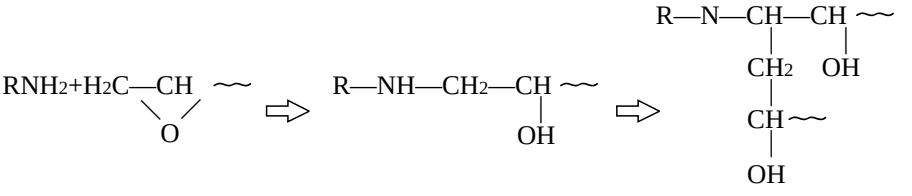

Fig. 2.22.1 Hardening process of epoxy adhesive

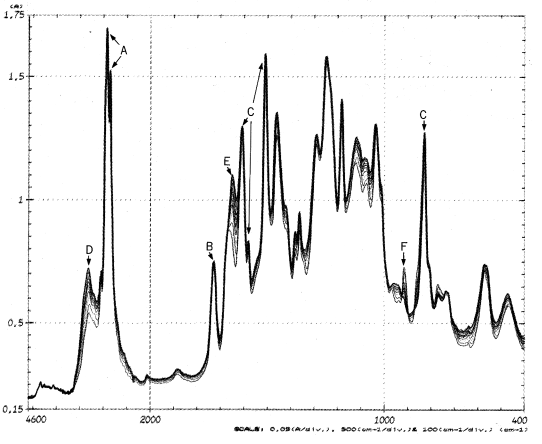

Fig. 2.22.2 Infrared spectrum of epoxy adhesive
(A: alkyl group B: carbonyl group C: benzene ring D: hydroxyl group E: amino group F: epoxy group)