Analysis of Corrosive Gases Produced During Polyimide Curing Process

Polyimides are widely used dielectric materials in the semiconductor industry. Gases evolved during the curing reaction, however, are corrosive to electronic circuits, causing reliability problems. This gas release can be studied using EGA-MS using the Double-Shot Pyrolyzer (Technical Note No. PYA3-001) as well as with TGA. Fig. 1 shows the curing reactions of polyimide films. First, BPDA and 3,3'-DDS are heated at a lower temperature to produce polyamic acids. Next, the material is further heated at a higher temperature to give cured polyimde. The TGA curve (Fig. 2) shows the weight losses in the curing process. The two distinct stages of reaction are clearly evident at 100~350ºC, and at 350~450ºC. Fig. 3 shows the results of an EGA-MS study of this process. The first stage TGA weight loss in Fig. 2 matches the evolved material in Fig. 3's region **A** and the second stage weight loss matches the EGA-MS data of region **B.**

The compounds produced by EGA were separated and determined by GC. With MS, selected ion monitoring was used to show the profile of some of the compounds of interest in Fig. 3. These results indicate that DMAc, CO2 and H2O are produced in the first stage of the curing process, and CO2, SO2 and aniline are produced in the second stage. As this example shows, EGA is an extremely useful tool for solving problems in polymer materials.

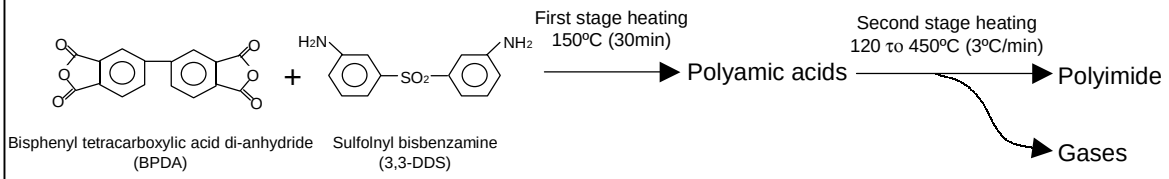

Fig. 1 Curing Process of Polyimide

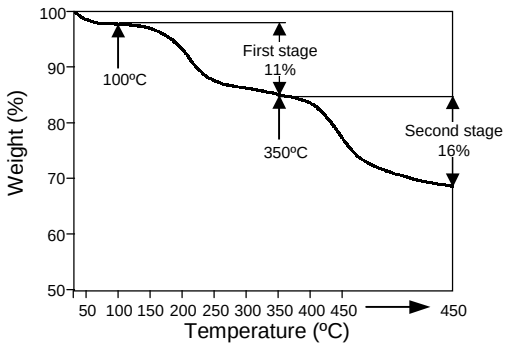

Fig. 2 TGA Curve for Polyimide Curing Process

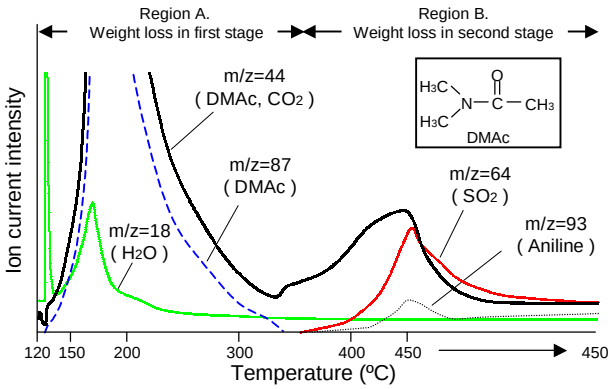

Fig. 3 EGA Curves of Polyimide Curing Process by Selected Ion Monitoring

Keyword : Polyimide, Curing Process, Semiconductor industry, TG, EGA

Application : General Polymer Analysis, Electronics, Microelectronics Industry

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