ABSTRACT

THESIS: The Infrared Spectroscopic Study of the Effects of Solvent Exposure on Polyimide Films

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PAGES: 32

The goal of this research was to observe the changes in thickness and chemical characteristics that occur in Kapton® , a type of polyimide film, when exposed to heated solvents commonly used in cleaning and processing of these materials. Interference fringes present in transmission infrared spectra were used to calculate the thickness changes of the film, and attenuated total reflection infrared spectroscopy (ATR) was used to observe spectral shifts of the polymer film.

Pieces of Kapton® film were immersed in heated solvents of n-methyl pyrrolidinone (NMP) and dimethylsulfoxide (DMSO) resulting in a rapid initial increase of film thickness by about 2.5 um during the first 20 minutes. After the initial increase and throughout the remainder of the 2 hour exposure, the film thickness varied little in the NMP solvent at all temperatures, 67, 95, and 125 ^{o}C. However, in DMSO, the behavior was more varied and this behavior was only observed in the 95 ^{o}C bath. The change in film thickness throughout the course of the experiment

was about 1 μm less in the 125 ^{o}C as compared to the 95 ^{o}C, perhaps due to dissolution of the film by the solvent.

When the film is exposed to heated solvents, a significant shift in the vibrational frequency of the asymmetric carbonyl stretch absorption to higher wavenumbers, as compared to the unexposed film, is observed. This indicates that there is some interaction between the Kapton® film and the solvent such that the strength of the carbonyl bond is lessened. Interactions could disrupt the intra- and intermolecular electron sharing and hinder the formation of the charged resonance form.