Application Note
280-SO-0007

Time Course Measurement with FTIR

Introduction

FTIR offer three methods for time course measurement: interval measurement, rapid-scan, and step-scan; the time resolution is 1 sec, 50 msec, 5 msec (optional: 10 nsec) respectively.

FT/IR-4000 and 6000 Series
Spectrometers

Here we will review the basic features and measurement for each method. Each method uses a different type of scanning method for the moving mirror in the interferometer. “Interval measurement” is performed with regular scanning and “rapid-scan measurement” uses a faster scan rate of the moving mirror. Using “step-scan measurement,” the moving mirror stops at each data-sampling point and perturbed at each of the points.

Measurement Conditions		
Interval Measurement[*1]	**Time Res.:** 1 sec ~	**Application:** structural transition of a sample, monitoring of gas concentration
Measurement Ex.: Measure the transition of CO_2 concentration in room air. (Fig. 1) Interval measurement is effective for long-time monitoring of gas analysis. [*1] JASCO interval measurement program can be used for up to 60001 scans or 24 days.		
Rapid-Scan Measurement	**Time Res.:** 50 msec ~	**Application:** photo-polymerization reaction, orientation relaxation of polymer film
Measurement Ex.: The curing process of a UV cured resin was measured, a photo-polymerization reaction. (Fig. 2) The peak intensity transition at 1637 cm^{-1} (bottom of Fig. 2) is attributed to the C=C stretch. The peak intensity rapidly decreased responding to the UV irradiation and continued to decrease moderately indicating that the initial reaction and reaction process for photo-polymerization was observed very accurately.		
Step-Scan Measurement[*2]	**Time Res.:** 5 msec ~[*3]	**Application:** relaxation of liquid crystal orientation
Measurement Ex.: The relaxation process of the orientation of a liquid crystal in response to an electric field was measured. (Fig. 3) The peak intensity transition at 2925 cm^{-1} (bottom of Fig. 3), is attributed to the C-H stretch. The peak intensity fluctuated responding to the power voltage being applied and stopped, and decreased in two phases - rapidly and then moderately. It is known that the liquid crystal in the area near the electrode has a faster orientation relaxation than the bulk and this difference can be observed. [*2] limited to the materials with repetitive response. [*3] 10 nsec ~ is optionally available.		

JASCO INC.
28600 Mary's Court, Easton, MD 21601 USA
Tel: (800) 333-5272, Fax: (410) 822-7526
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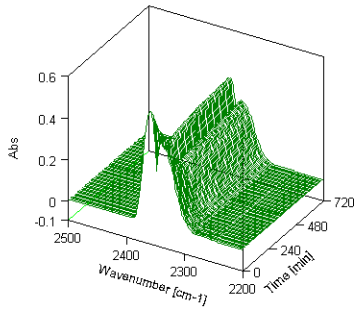
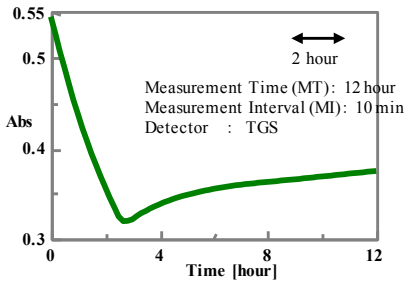
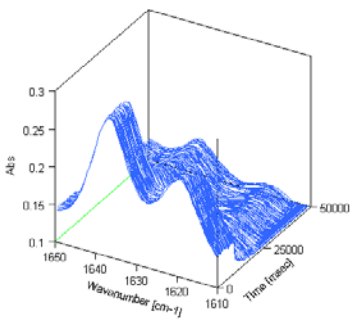


3D Spectrum



Peak intensity transition at 2360 cm^{-1}

Figure 1. CO_2 concentration transition



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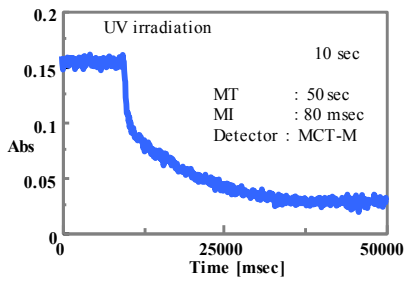
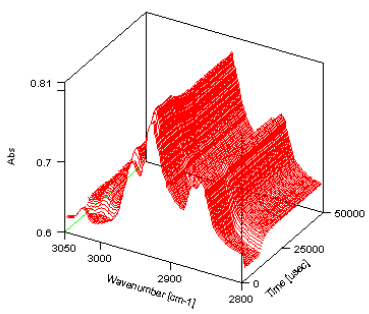


Peak intensity transition at 1637 cm^{-1}

Figure 2. Curing process of a UV cured resin



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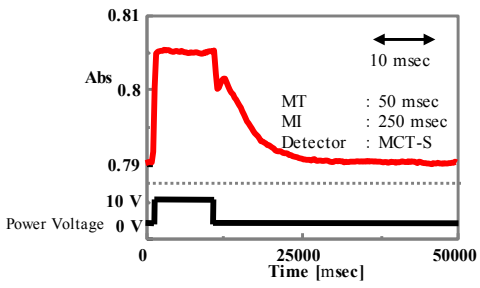

Peak intensity transition at 2925 cm^{-1}

Figure 3. Relaxation process of liquid crystal orientation

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