



Hybrid Pyrolyzer
JHI-08

Analysis using Hybrid Pyrolyzer 2 “Hybrid” Analysis of Nylon6

Keyword:

Pyrolysis-GC/MS, Thermal Extraction-GC/MS, Additives Analysis, Polymer Composition Analysis

Introduction

JHI-08 is a pyrolyzer for GC/MS having two ways of heating system, high frequency induction heating and resistance heating. High frequency induction heating system can raise temperature instantly and therefore is good for pyrolysis, while resistance heating, where you can program heating rate and final temperature as you like, is good for thermal extraction analysis.

Further, JHI-08 has “Hybrid Mode” under which you can conduct thermal extraction analysis and pyrolysis analysis on one sample continuously without interruption.

The hybrid mode analysis is quite useful as more data can be obtained from limited amount of sample.

Here is an example of analysis using Hybrid Mode of JHI-08.

Experiment

Sample : Nylon 6 (General Grade, pellet form)

Instruments : Hybrid pyrolyzer JHI-08, Column Inlet Cooler (Optional), GC/MS

Analysis Overview

Fig. 1 shows the entire analysis flow. Everything goes automatically under the hybrid mode.

The first analysis was thermal extraction-GC/MS analysis where residual solvents, unreacted monomers, additives and others were analyzed.

The second analysis, which started immediately after the first one, was pyrolysis-GC/MS analysis for polymer composition.

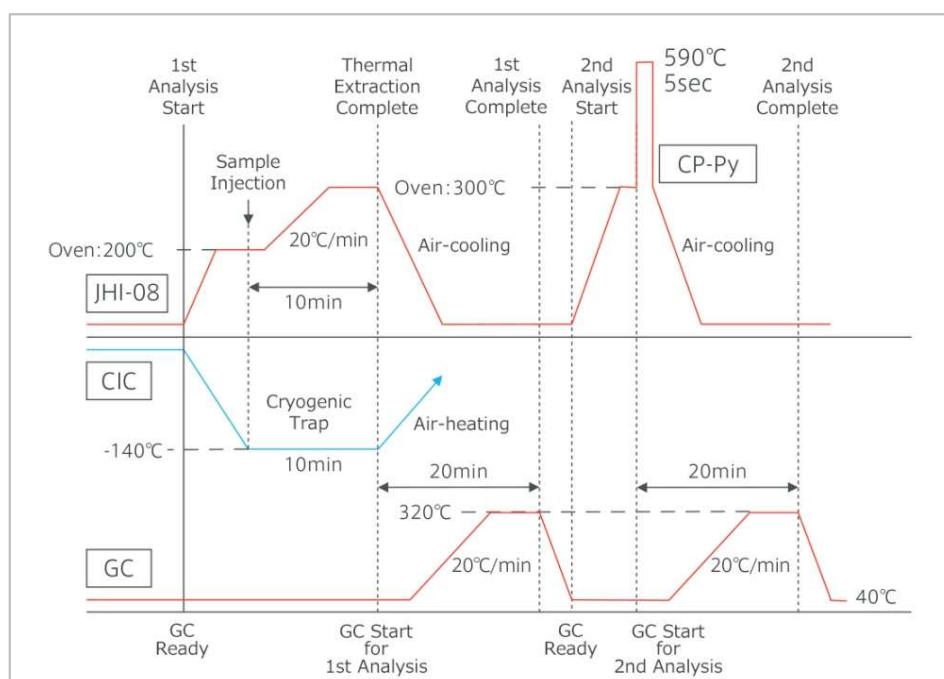


Fig. 1 Automatic Analysis Flow Overview

Results

The 1st analysis (Thermal Extraction-GC/MS)

Extraction Temperature

200°C (1 min) > 20°C/min > 300°C (4 min)

Thermally-extracted gas was cooled down to -140°C by CIC and was trapped there. After extraction completed and the gas was totally trapped, GC column oven temperature was raised as programmed. Thermal extraction chromatogram was obtained as shown in Fig. 2.

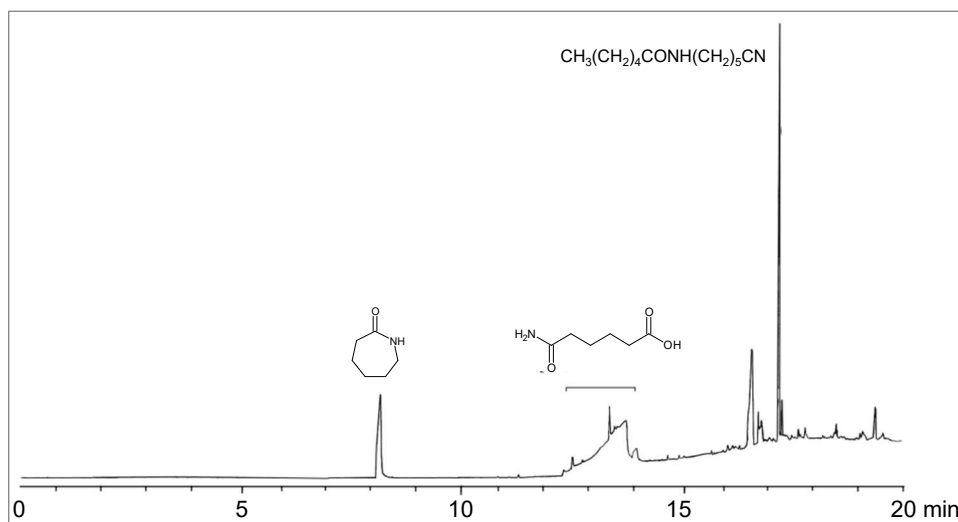


Fig. 2

The 2nd analysis (Pyrolysis-GC/MS)

Pyrolysis temperature : 590°C

(Pyrofoil® F590)

After pyrolysis-GC/MS analysis, the pyrogram was obtained as shown in Fig. 3.

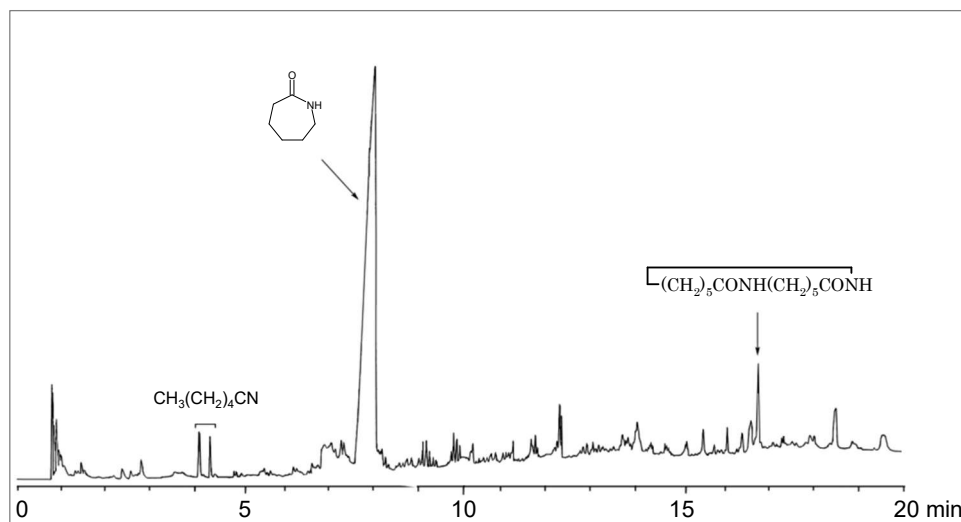


Fig. 3

Conclusions and Discussion

Nylon6 is generally believed to outgas a little and therefore is often used for electronic devices. However, as shown in Fig. 2, a broad peak (high polarity compound) was observed at around 13.6 min. on thermal extraction chromatogram. The structure is assumed to be the one shown on Fig. 2, having both amide and carboxy groups. As it was not observed on the pyrogram (Fig. 3), it is presumed to have been generated during the thermal extraction process.