CDS solutions

APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Pyrolysis of Polyethylene in Five Atmospheres

Analytical pyrolysis is generally performed in a vacuum or an inert gas, usually the carrier gas of a GC/MS. Under these conditions, the polymer is split to smaller molecules, frequently via free radical mechanisms which rapidly produce stable molecules. Polyethylene, for example, produces a series of normal alkanes, alkenes and dienes as shown in the pyrograms in Figure 1. All runs were performed in the stated atmosphere with the products collected onto a Tenax trap, then transferred and analyzed in helium by GC/MS. Changing the atmosphere to nitrogen or argon has little effect on the products made. Because the free radical reactions are so rapid, even performing the pyrolysis in hydrogen results in little if any hydrogenation of the pyrolysis products. For the intentional hydrogenation of these products, a reactor with a suitable catalyst must be used as a second step in the process.

When the pyrolysis is done in air, however, there is a noticeable oxidation of some of the products. This produces a second series of peaks, which are aldehydes and elute between the triplet peaks of the hydrocarbons. Figure 2 expands the pyrograms to show the positions of these oxidation products.

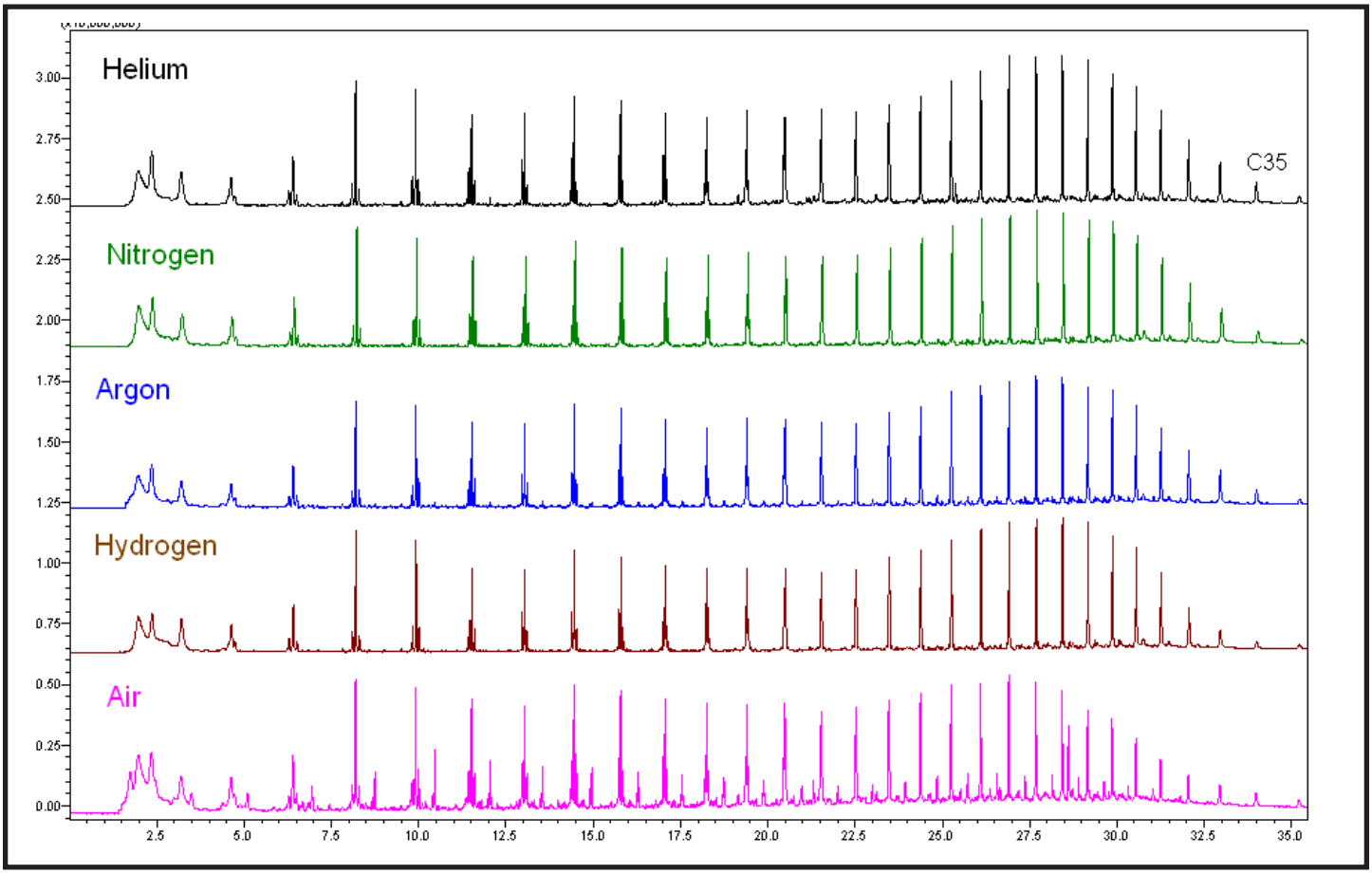

Figure 1. Pyrolysis of Polyethylene in five atmospheres, at 750°C with GC/MS analysis in helium.

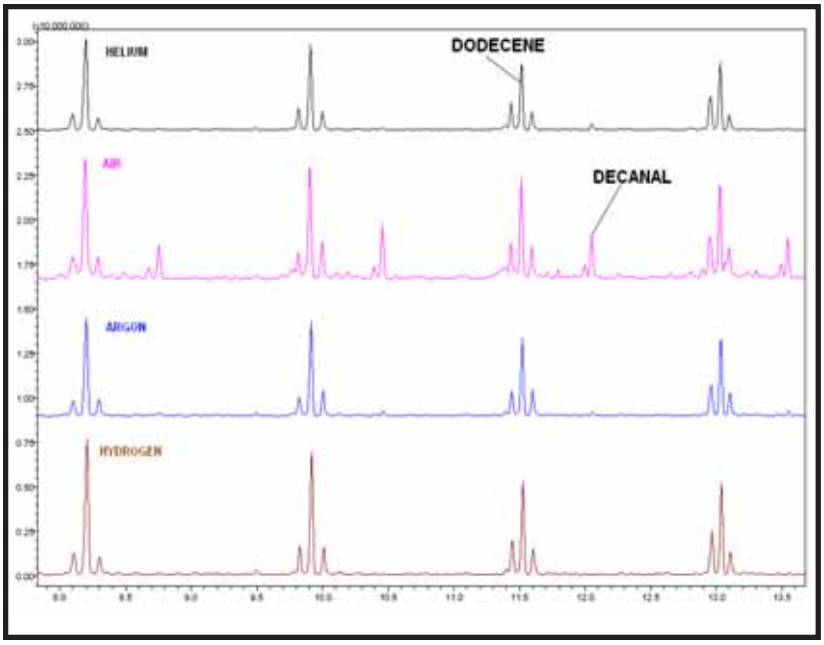

Figure 2. Expanded pyrograms showing aldehydes produced when Polyethylene is pyrolyzed in air.

Experimental Parameters

All samples were pyrolyzed using a CDS Pyroprobe 5200 equipped with a Tenax trap.

Pyroprobe

Pyrolysis:	750°C for 15 seconds
Interface:	300°C for 4 minutes
Carrier flow:	30 ml/min
Trap initial:	40°C
Trap desorption:	300°C for 4 minutes

GC/MS

Column:	30 m x 0.25 mm 5% phenyl MS
Carrier:	Helium
Split:	50:1
Oven program:	40°C for 2 minutes
	10°C/minute to 325°C

FOR MORE INFORMATION CONCERNING THIS APPLICATION, WE RECOMMEND THE FOLLOWING READING:

T. P. Wampler and E. J. Levy, J. Anal. Appl. Pyrolysis, 8, (1985) 153-161.

S. Tsuge et al., J. Anal. Appl. Pyrolysis, 1, (1980) 221-229.

Additional literature on this and related applications may be obtained by contacting your local CDS Analytical representative, or directly from CDS at the address below.

CDS Analytical, LLC. has been a leader in the design and manufacture of laboratory instruments for sample preparation and analysis since 1969. We are dedicated to providing the best possible instruments for both research and routine analysis. Well known in the field of pyrolysis, CDS manufactures the Pyroprobeâ 5000, 5150, 5200 and 5250 autosampler for the introduction and analysis of solid materials by GC, MS and FT-IR. CDS offers a complete line of dynamic headspace instruments for the analysis of volatile organic compounds in environmental, pharmaceutical and food applications, including the model 8400 four-position autosampler. CDS also manufactures the Dynatherm line of thermal desorption instruments including the 9000 series for air monitoring and the 9300 TDA . Our customers, their requirements and applications are important to us. To help meet your needs, we offer a wide range of analytical information and the services of our applications laboratory. If you would like additional information, please contact us at the address below, call us at 1 800 541 6593, or log onto **www. cdsanalytical.com.**

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