Multi-Shot Pyrolyzer®
EGA/PY-3030D

Flexible
Versatile
Reproducible

FRONTIER LAB
Why Evolved Gas Analysis?
Why Pyrolysis?

Today, analytical pyrolysis encompasses much more than simple flash pyrolysis of polymeric materials. Virtually any material (liquid or solid) can be characterized using an array of techniques, which are designed into a modern day, Multi-Functional Pyrolysis System. Consider how these techniques can help you quickly solve the most difficult analytical challenge:

Analytical Techniques:
- Evolved Gas Analysis (EGA)
- Pyrolysis (PY)
- Reactive Pyrolysis (RxPY)
- Multi-step Thermal Desorption (TD)
- Thermal Desorption followed by Pyrolysis (Double-Shot)
- Heart cuts based on the EGA thermogram
- UV Irradiation
- Conventional sorbent based thermal desorption
- High pressure, high temperature reaction chemistry

Examples of what can be done with a pyrolysis system, like the EGA/PY-3030D:

Thermal Desorption-GC/MS
- Phthalates in PVC
- Residual bisphenol A in polycarbonate
- Herbicides in wood pulp
- Volatiles formed during irradiation
- Hydrocarbon profiles of various shale oils
- High temperature fuel additives
- Outgassing of electronic components
- Outgassing of medical devices

Reactive Pyrolysis GC/MS - in less than one hour
- Fatty acids in a grain
- Fatty acids in a variety of biomass materials
- Fatty acids in cosmetics

Double-Shot GC/MS
- Additives in rubber
- Additives in paints, varnishes
- Contamination of disk drives

What's new from Frontier Laboratories?

Why are most laboratories integrating the Frontier Multi-Shot Pyrolyzer into their mainstream analytical protocols?

Guaranteed reproducibility and accuracy
Every facet of the system is designed to ensure reliability and data quality. All wetted surfaces are quartz, there is no transfer line, there is no cross contamination.

Versatility
The Pyrolyzer can be configured to analyze C2 vapors, C100 solids and everything in between.

Increase laboratory productivity
Sample prep takes less than five minutes; the low mass ceramic furnace heats and cools in record time.

Analyze any sample matrix
Virtually any material (gas, liquid or solid) can be chemically characterized.

Tools to help understand the data
F-Search software and four MS libraries utilize MS and GC data to simplify data interpretation.

Precision and accuracy reflect the thermal homogeneity of the system thermal gradients between the 3030D and GC are eliminated by replacing the standard septum nut with one that fits snugly into the unique heat sink adapter at the bottom of the pyrolyzer. The effectiveness of this design is underscored by the C100 chromatogram.
Frontier Laboratories' new Multi-Shot Pyrolyzer EGA/PY-3030D is based upon the proven superiority of their patented vertical micro furnace, but everything else is new. A low mass ceramic heater heats and cools quickly. The needle interface has been re-designed to ensure thermal uniformity. The temperature control algorithm literally guarantees temperature reproducibility (±0.1°C) and the operating software has a number of new features. The concept is sound, the design is simple and the engineering first rate; a two year warranty is standard — from day one!

Two new samplers give the 3030D Pyrolyzer an even larger role in the analytical laboratory. Odors and other VOCs can be concentrated on conventional sorbents like Tenax and thermally desorbed using the TD Sampler. High pressure, high temperature chemistry can be investigated using the micro reactor sampler. Couple these two samplers with the many innovative accessories that can be added to the 3030D with the power of F-Search Software — you will agree that Frontier is all about analytical performance, versatility and capability.

Versatility: One instrument, multiple analytical techniques

The Pyrolyzer EGA/PY-3030D can be configured with five different samplers (shown) and other accessories. By simply changing the sampler, the 3030D can be used to make liquid injections, desorb sorbent tubes or SPME fibers, investigate reactions at high pressure and even monitor the volatiles released as a material is UV irradiated. There is a configuration for nearly every analytical challenge: from C2 to C100, literally ethane to Shale!

For more information see www.frontier-lab.com

guaranteed reproducibility
Abstract: When working with challenging samples, such as an eyeliner pencil, the first step is to characterize the sample using evolved gas analysis (EGA-MS). Analysis of the EGA thermogram provides information about the thermal complexity of the sample, the nature of the polymer, and the presence or absence of specific compounds of interest. EGA will help the analyst select the next step in the process.

A good example of using EGA to suggest what analysis will yield the most useful information about the sample is characteristics of a commercial eyeliner. Like many cosmetics, eyeliner is a complex mixture of compounds ranging from volatiles to polymers.

The eyeliner is placed directly into the sample cup and analyzed directly; there is no sample prep.

Material characterization using the multi-mode capability of the Frontier Pyrolyzer EGA/PY-3030D

EGA thermogram reflects thermal properties of the entire sample
The EGA thermogram of the eyeliner (on the right) has three peaks: A, B, and C which are the volatiles in the sample and two peaks: D and E which originate from the polymeric portion of the sample.

F-Search displays two-dimensional multi-ion mass chromatograms
The data indicates that peaks A and B contain multiple components. Peaks D and E can be tentatively identified using F-Search and the EGA-MS library.

Identification of volatiles (A, B, C): F-Search (EGA and additives) / NIST, Wiley library
Identification of volatiles (D, E) originated from polymer: F-Search (polymer and pyrolyzates libraries)
Identification of volatiles (A, B, C, D, E): user generated library

Heart-cut analysis (EGA-GC/MS)
Vapors evolving from each EGA thermal zone are selectively introduced into the GC separation column and analyzed by GC/MS. Using the selective sampler and the MicroJet Cryo-Trap up to eight thermal zones can be isolated and analyzed.

Shown below are the chromatograms obtained when each of the EGA thermal zones (A – E) is analyzed sequentially. The entire method can be automated using the auto-shot sampler.

Qualitative and quantitative analysis based on data from varied sources including F-Search and other analytical techniques
- Identification of volatiles (A, B, C): F-Search (EGA and additives) / NIST, Wiley library
- Identification of volatiles (D, E) originated from polymer: F-Search (polymer and pyrolyzates libraries)
- Identification of volatiles (A, B, C, D, E): user generated library
Up to 48 samples can be analyzed. When performing multiple analyses on a single sample, the sample is held at near-ambient temperature between analyses. The sample path has one isolation valve and two magnetic cup positioning valves which are always at ambient temperature.

The automated analysis of multiple samples requiring different analytical modes can be analyzed in a single sequence. Evolved gas analysis (EGA), which is done with a tube rather than a separating column, requires a separate sequence table.
F-Search is used to identify individual compounds and/or polymers using a patented search algorithm and specialized Frontier MS libraries. The libraries include GC as well as MS chromatograms. Each library can be edited. In addition, custom in-house libraries can be created. Four libraries are available: polymer, pyrolyzates, additives and EGA thermograms.

The GC/MS data obtained with the instruments manufactured by Agilent Technologies, Shimadzu, and JEOL can be searched without modification. Data generated on GC/MS instruments manufactured by other companies can also be searched after converting the data file to a NetCDF (AIA).

If your system includes the NIST/EPA/NIH mass spectral library (National Institute of Standards and Technology) and its search engine software, it can be accessed directly from within F-Search.

The partial results for a typical library search are illustrated below.

The average MS spectrum of the unknown along with the averaged spectrum of the two best matches are shown. A table showing match quality is presented.

The pyrograms of the unknown and the two best matches are displayed for comparative purposes.
Compatibility & Support

The Pyrolyzer EGA/PY-3030D can be installed on any GC that is manufactured by a major instrument company.

All Frontier distributors receive periodic service training in Japan and are able to service the pyrolyzer, the sampler and all accessories.

A number of operational and maintenance videos are available on the Frontier website.