



Leaders In GC Sample Introduction Technology



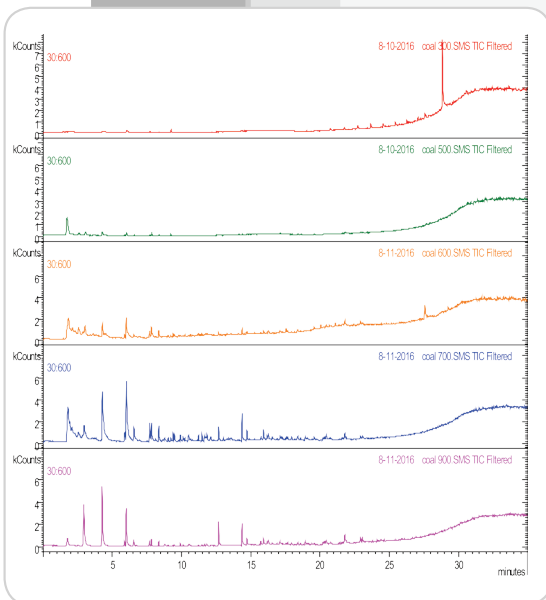
CDS 6000 Series Pyroprobe

- **Thermal GC Injection** Systems for Pyrolysis, Thermal Desorption, Dynamic Headspace and Evolved Gas

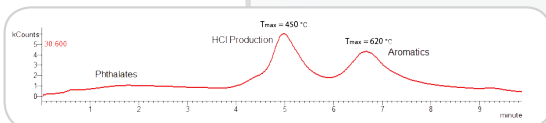
Introduction

CDS Analytical has proudly manufactured pyrolyzers and specialized GC injection systems for almost 50 years. Our products have been sold in over 100 countries and we still have many of our original systems in operation.

We are excited to be releasing our 6th generation pyrolysis system, the 6000 series. It includes capabilities that were unimaginable when we introduced our first system (the Model 100) in 1970, and many of these new features are not available in any other commercial pyrolyzer.



5-step TD/pyrolysis of coal



EGA of a plastic at 100°C/minute direct to the MS

Multi-Step Pyrolysis

In pyrolysis, sample molecules are exposed to thermal energy to introduce bond cleavage. Due to the unique design of CDS's resistively heated filament, thermal mass is minimized and samples are guaranteed to pyrolyze with the highest reproducibility, and without secondary pyrolysis fragments. Resistively heated filaments also cool and heat faster, which allows the widest range of programming temperatures when compared to other pyrolyzer techniques.

Evolved Gas Analysis

CDS pyrolyzers allow users to program the heating rate. With slow temperature ramping, it is possible to send evolved compounds directly to the MS through a fused silica column. This technique offers a fast screening method by characterizing the temperature at which volatile compounds desorb and the polymer starts to break down.

Thermal Desorption / Dynamic Headspace

Swapping with the optional Thermal Desorption module, the 6200 Series pyrolyzer can easily be converted to a Thermal Desorption system capable of desorbing any standard size glass or stainless steel Thermal Desorption tube on the market. An optional Dynamic Headspace vessel (~25 ml) is also available.

CDS Pyrolyzers are much more than a polymer introduction system. With the advancements made in our pyrolysis instruments, we now consider them thermal injection systems that can tackle the most difficult chromatography sample matrix, whether solid, liquid or gas. Our pyrolyzers are fully programmable with the widest temperature settings and ramp rates in the industry. With proper accessories and programming for your application, the instruments can be used for Evolved Gas Analysis (EGA), Thermal Desorption, Reactive Gas Pyrolysis, Dynamic Headspace, High-Pressure Pyrolysis, Direct PY-MS, PY-FTIR, and even catalyst testing.

We invite you to join our extended list of satisfied customers and, you should know that our application lab, support and expertise is always available throughout the life of your investment.

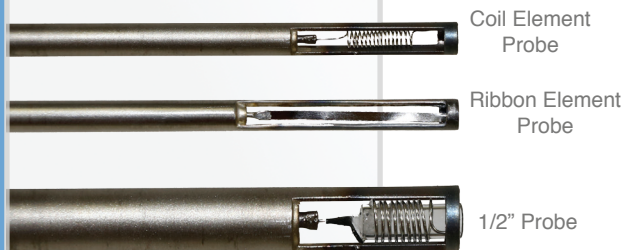
State of the Art in Thermal Injection Systems

CDS pyrolyzers use a reliable and repeatable Platinum filament heating system. The microprocessor in the electronics controls the temperature of the filament by calculating the resistance of the filament at set point temperature, monitoring and adjusting the voltage to achieve that temperature. An incredible maximum heating rate of 20,000°C/second is achievable, which assures the most consistent scission of polymers for unmatched quantitative accuracies and repeatability.

Probes are available in a variety of designs and sizes, including a flat ribbon probe where the sample is directly placed on the platinum for maximum heat transfer, and a coil probe, where samples are inserted into quartz tubes or boats before inserting into the coil filament. Also, we now offer an easy to use drop in chamber that eliminates the need to insert the sample tube into the coil probe.

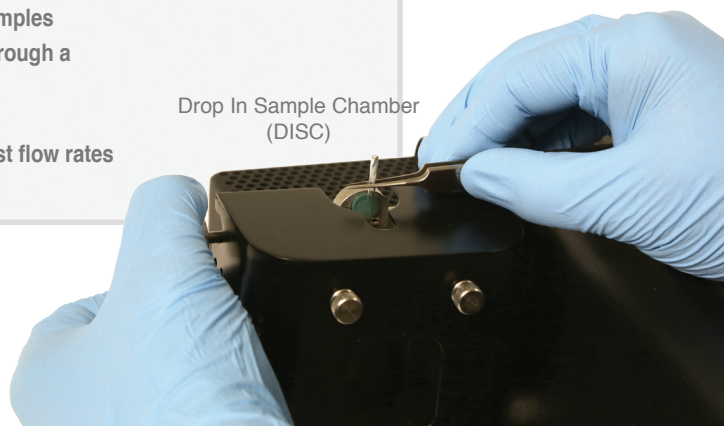
Probes for Every Application

- Drop In Sample Chamber (DISC) probe - Novel design for routine and quick analysis of any sample matrix
- Coil Element - Best for samples held in reusable quartz tubes or boats
- Ribbon Element - Ideal for film and solvent deposited solids
- 1/2" probe for heating oversized samples up to 350 mg



Capability Summary

- Best Guaranteed System Accuracy < 2% RSD*
- Upgradable Firmware
- New Automated Leak Check capabilities
- Program purge to vent to eliminate unwanted solvents or volatiles before analyzing the sample
- Extensive diagnostic abilities aid in trouble shooting down to component level
- Monitor your system remotely with the WiFi capabilities
- Includes a pyrolysis and thermal desorption library of 50 preprogrammed methods
- Optional features include
 1. Analytical trapping and reactant gas capabilities so you can pyrolyze in oxygen, hydrogen or any gas of your choice
 2. Autosamplers, both trapping and non trapping
 3. Libraries for polymers and additives
 4. Option to desorb TD tubes for VOC in air analysis
 5. Dynamic headspace vessel (25 mL) for large samples
 6. Pyrolyze at elevated pressures, in steam and through a catalytic reactor
 7. Interface to an FTIR
 8. Mass Flow Control option to automatically adjust flow rates

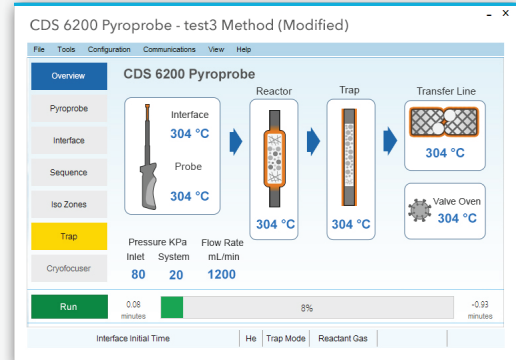


The CDS 6000 Pyroprobe Series

The 6000 series was designed with flexibility and modularity in mind. You can order the basic 6150 today and then upgrade to any of our additional features in the future, as your needs change. The basic programming features on all 6000 series models are noted below.

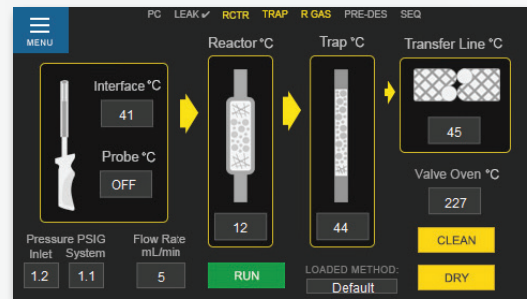


1



Windows 10 Compatible Digital Control Interface (DCI)

2



User-friendly Touch Screen Interface

Basic Program Features Include:

Programmable Temperature Range:

Temperature Accuracy:

Heating Rates:

Probe Clean and Sample Dry:

Steps:

Interface Type:

Interface Temperature:

Interface Heating Rates:

GC Connection:

Valve Oven:

Dimensions:

Weight:

From ambient to 1400°C, in 1°C increments

+/- 1°C

0.01°C/ms to 20.0°C/ms

0.01°C/sec to 999.9°C/sec

0.01°C/min to 999.9°C/min

Temperature user-selectable

Up to 10 temperature profiles with a GC start per step. Allows for multiple thermal desorption or pyrolysis steps on each sample.

Low-mass programmable zone to assist in thermal extraction or evolved gas studies

Settable in 1°C increments to 400°C

Programmable in 1°C/min to 100°C/min

Heated sample line through injection port up to 375°C

Settable in 1°C increments to 350°C

381 mm (15") W x 292.1 mm (11.5") H x 406.4 mm (16") D

16.3 kg (36 lb)

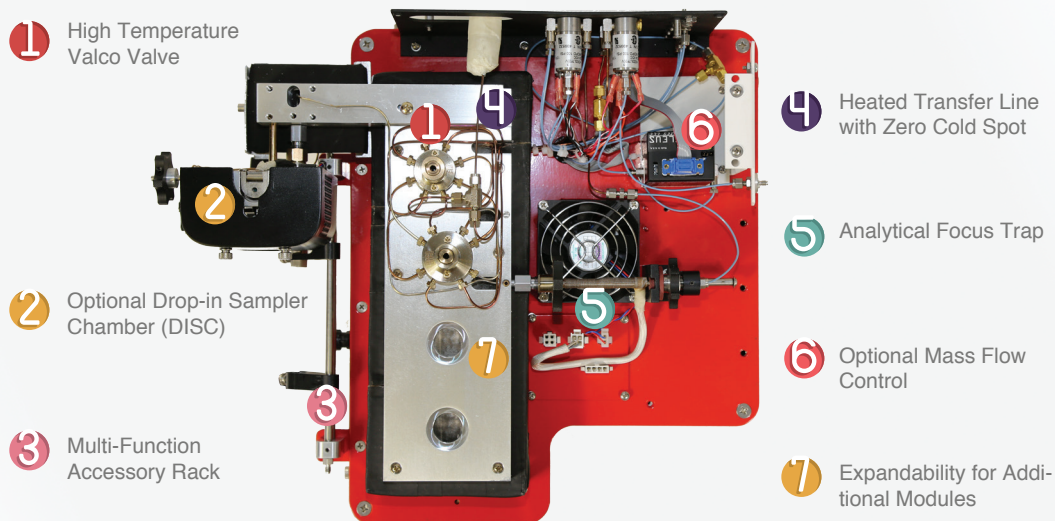
The CDS Pyroprobe 6150

Our base model instrument for pyrolyzing in GC carrier gas only. The 6150 connects to any model GC with a heated sample line for easy on/off installation. Low-mass programmable interface allows for thermal desorption of volatiles before pyrolyzing the sample.

The CDS Pyroprobe 6200

Includes All 6150 Functionality Plus These Value-Added Features:

A built-in analytical trap which enables the instrument to collect analytes using slow rate pyrolysis, use a reactant gas (like oxygen and air), or perform thermal desorption on sorbent tubes or larger samples. Unique interface design permits direct pyrolysis path to GC inlet, or heating and transfer to trap, with no interruption of GC pneumatics. Optional test tube desorber can be heated up to 300°C for running dynamic headspace experiments on larger samples. Optional external DHS chambers of 130mL and 800mL are also available.



Pyrolysis and Interface Programming Same as 6150

Trapping and Reactant Gas Pyrolysis Capabilities

Interface Type: Pyrolysis to built-in trap or direct to GC
Trap Heating Rate: 1000°C/min
Trap Temperature: Ambient to 400°C
Trap Packing: Tenax-TA™ standard
 Other packings available.

Dynamic Headspace Option

Type: 25mL test tube chamber and NEW 800mL vessel
Heating capability: Up to 300°C
Purge time: Up to 999.99 minutes

Optional Cryotrap

Liquid N2 cooled and programable to: -150°C

Polymer Library

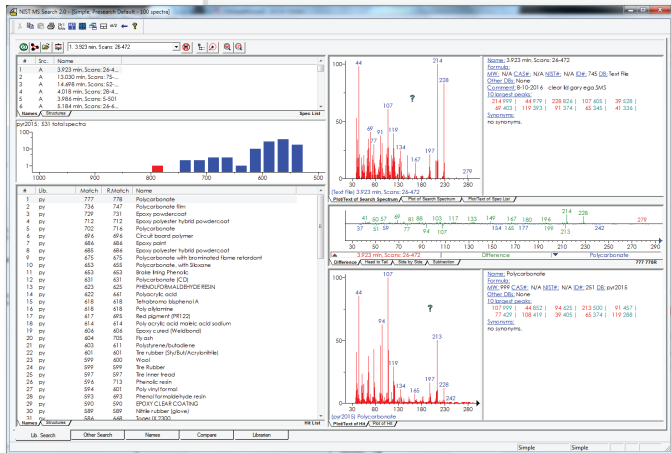
Since the analytical process of pyrolysis is to break down a polymer to volatile fragments, the MS can only identify the fragments, and not the original polymer. To help address this need, CDS has developed an effective means of searching unknown pyrograms with your existing MS to identify the polymer used in the sample matrix.

The CDS polymer library is built on 500+ individually averaged spectra of industry standard polymers. When you run a sample through your GC/MS, you simply average the complete TIC spectra and then compare it to the CDS polymer library. Using the search engine (for example NIST), you will have a list of possible matches from the CDS library.

Combining averaged mass spectra with a pyrogram TIC creates a powerful two-prong method of polymeric material analysis. The technique allows analysis of individual pyrogram peaks using standard searching libraries while offering the polymer's chromatographic pattern characteristics. It also allows users to apply existing computer searching techniques to the polymer as a whole.

And, you have the ability to add your own standards to the library. This is accomplished by running your standard, averaging the TIC spectra and then entering it as a file into the CDS library. As we continue to build upon our own library, you will have access to free library upgrades for the life of your instrument, so you will be assured that you have the latest data interpretation tools commercially available.

Current compounds in the library include most of the common industrial polymers in use today, copolymers, finished products and even biopolymers. See example of Polycarbonate film.



Polymer Additive Identification

The number of polymer additives today is vast and growing constantly, making it increasingly difficult to detect trace-level additives in a polymer sample. To tackle this analytical challenge, CDS has assembled an additive library containing 500+ compounds, many of which are not found in a NIST or Wiley library. Our library is used with one of several leading deconvolution software packages, for example AMDIS (available free from NIST).

By pairing deconvolution software with the CDS Additive Library, users can search chromatograms (from pyrolyzed or thermally desorbed samples) by specific compound or compound categories. Our library is compatible with most major MS softwares, providing they use a compatible deconvolution package noted above. The software searches and identifies additives stored in the library and can be used down to the ppm level.

Supplement the knowledge base yourself, and take advantage of the regular stream of CDS updates as you wish. Since additives are grouped by category you can limit searches to ones of interest only.

Markets Served

- Automotive: plastics, rubbers, exhaust/filters, panels, tires, paint
- Consumer Products: film, shaving products, waxes, adhesives, glues, textiles, packaging
- Energy: oil characterization, coal, biomass, algae, source rock
- Forensic: auto paint, tires, random polymer analysis, arson
- Paints & Coatings: polymer and additive analysis/quantitation
- Paper: specialty inks and coatings, sizing agents, toners
- Pharmaceuticals: trace polymers, pill coatings, additives, medical devices and implants
- Plastics/Rubbers: polymer quantitation and ID, additives, thermal stability testing
- Tobacco: cigarettes, filters, papers, flavor additives

Applications

CDS pyrolyzers have been used in almost every industry where you find a GC. From industrial polymers to biopolymers to additives, pyrolysis can become one of your most invaluable tools. The following are a few examples of both, common and specialized applications.

Below are some examples:

- Multistep run of a polymer with additives
- Tobacco in air analysis
- Trace polymeric additive analysis
- Auto paint or tire analysis
- Medical device analysis
- Forensics



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Thermal Desorption

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Purge and Trap

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