



The University of Kentucky's Center for Applied Energy Research (CAER) maintains an analytical laboratory that offers a variety of services ranging from sample analysis to long-term collaborative research. Our experienced professionals, along with the state of the art instrumentation combine to provide you with an unsurpassed problem solving capability that can be tailored to your specific needs.

The CAER provides a focal point for energy and environmental research at UK. The analytical support program meets clients' demands for high quality, cost-effective, analytical measurements and services.



**For more information on the CAER's analytical services, contact:**

Gerald A. Thomas  
Analytical Services Manager  
University of Kentucky,  
Center for Applied Energy Research  
2540 Research Park Drive  
Lexington, KY 40511-8479  
859.257.0282  
859.257.0302 fax  
thomas@caer.uky.edu

or for a no-charge cost estimate/consultation contact:

Darrell Taulbee, Ph.D.  
Industrial Support Coordinator  
University of Kentucky,  
Center for Applied Energy Research  
2540 Research Park Drive  
Lexington, KY 40511-8479  
859.257.0238  
859.257.0302 fax  
taulbee@caer.uky.edu

Center for Applied Energy Research

## Analytical Capabilities

Analytical Services

Partnerships

Contract Research



UNIVERSITY OF KENTUCKY  
CENTER FOR APPLIED ENERGY RESEARCH



## Chromatographic Analysis

### Gas Chromatography

(C<sub>1</sub>-C<sub>7</sub>, H<sub>2</sub>, CO, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>)  
Capillary/Packed Column  
Simulated Distillation

### Ion Chromatography

Cation scan (Li<sup>+</sup>, Na<sup>+</sup>, NH<sub>4</sub><sup>+</sup>, K<sup>+</sup>)  
Anion scan (F<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup>, PO<sub>4</sub><sup>3-</sup>, SO<sub>4</sub><sup>2-</sup>)

## Spectroscopic Analysis

### X-Ray Powder Diffraction (XRD)

High temperature in-situ XRD  
General analysis and JCPDS Search  
Clay Mineralogy

### X-Ray Fluorescence (XRF)

Wavelength Dispersive

### Electron Microscopy (SEM)

SEM/STEM

### Infrared (FT-i.r.)

Solids/liquids  
Transmittance/Reflectance  
In-situ heated ATR/cell

### Raman (FT Raman)

Solids/liquids

### Ultraviolet/Visible (UV/VIS)

## Metals Analysis

Inductively coupled plasma-mass spectroscopy (ICP-MS)  
Inductively coupled ultrasonic nebulizer (ICP)

## Thermal Analysis

TGA	TGA/MS
DSC	TGA/DSC
DTA	TG/DSC/MS
DMA	Rheometry
LFA	



## Surface Analysis

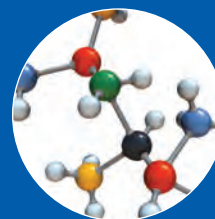
BET Surface Area  
Partial or Full N<sub>2</sub> Isotherm; static or continuous  
Specialty Gas Adsorption  
SEM/STEM  
TPD-MS

## Physical Measurements

Density (Liquid and Solid)	Calorimetry (BTU/lb)
Distillations	Viscosity
(ASTM D-86)	Surface Tension
(ASTM D-1160)	TAM Micro Calorimeter
(Prep 51)	

## Sample Preparation

Bulk samples  
Crush/dry/riffle/blend  
Grinding/Milling  
Wet/dry sieving  
Low Temperature Ashing (LTA)  
Open and Closed Vessel Microwave



## Particle Size Analysis

Malvern (0.1μ - 2 mm)  
Laser Diffraction  
Multiple Sieve-Mesh Sizing (dry/wet)

## Coal/Coke/Oils Testing

Ultimate (M, A, C, H, N, S, O by difference)  
Proximate (M, A, VM, FC)  
Fuel Test (M, A, S, BTU/lb)  
Moisture (drying/Karl Fischer)  
Volatile Matter  
Ash  
Major Elements in Ash  
(MgO, Na<sub>2</sub>O, TiO<sub>2</sub>, SiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, SO<sub>3</sub>)  
Minor Elements in Ash  
(Mo, Zn, Cu, Ni, Co, Cr, Ba, V, Mn, Rb, Sr, Zr)  
Carbon, Hydrogen, Nitrogen  
Inorganic Carbon (carbonate)  
Sulfur Forms (Pyritic, Sulfate, Organic by difference)  
Trace Level Nitrogen  
Chlorine  
Free Swelling Index  
Hardgrove Grindability  
Viscosity  
Surface Tension

## Petrography

Petrographic Pellet Prep	Microscopic Mineral Analysis
Maceral Count	Reflectance
Blue/UV Light Analysis	Fly Ash Petrography

## Adsorbent Carbons Analysis

Moisture at 140 °C	Ash at 650 °C
Apparent Density	Particle-Size Distribution
pH of Activated Carbon	Ball-Pan hardness
Iodine Number	Carbon Tetrachloride Activity
BET Surface Area	Thermal/Chemical Activation

## Environmental Analysis

Color	Turbidity
Acidity	Alkalinity
pH	Chloride Residual
Bromide	Chromium
Chloride	Sulfate
Fluoride	Sulfide
Phosphorus	Sulfite
Ammonia	Nitrate
Carbon Dioxide	Nitrite
Temperature	Specific Conductance
Odor	Hardness, Total
Surfactants	Oil and Grease
Solids:	TCLP, Non volatile Prep
Total (TS)	TCLP, Metals (8)
Total Dissolved (TDS)	EP Toxicity-Extraction
Total Suspended (TSS)	Column Leaching

## Electrochemical Testing

Electrochemical impedance spectroscopy  
AC and DC electrochemical measurements  
Cycle life testing of electrochemical power sources  
Electroanalytical measurements  
Corrosion coatings analysis

