

# CTC's Laboratory Services



- Chemical Analysis – Wet Chemistry and Instrumental Analysis
- Corrosion Testing and Characterization
- Destructive Testing
- Emissions Monitoring
- Fuels Analysis
- Materials Compatibility
- Metallurgical Analysis
- Physical Property Testing – Coating Evaluation
- Test Method Development

## **Testing. Validating. Providing Solutions that Work.**

The Laboratory Services at Concurrent Technologies Corporation (CTC) operates chemical, corrosion, materials, and coatings laboratories to provide testing development and consulting services. We evaluate processes to gauge effectiveness; work to find solutions to environmental problems; analyze coatings to determine the best alternative to achieve maximum performance and more, as determined by specific client needs.

CTC's chemists, biologists, environmental scientists and skilled technicians provide bench scale, pilot scale, production shop floor, and field services tailored toward client needs encompassing our many capabilities.

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# CTC's Laboratory Testing Methods

## Chemical Analysis -

### Instrumental Methods

- Differential Scanning Calorimetry (DSC)
- Elemental Analysis: Carbon, Oxygen, Nitrogen, Hydrogen, Sulfur
- Fourier Transform Infrared (FTIR) Spectrometry
- Gas Chromatography (GC)
- Gas Chromatography/Mass Spectrometry (GC/MS)
- High Pressure Liquid Chromatography (HPLC)
- Ion Chromatography (IC)
- Metals: Inductively Coupled Plasma/Optical Emission Spectrometry (ICP/OES)
- Thermogravimetric Analysis (TGA)
- X-ray Fluorescence (XRF)

## Chemical Analysis -

### Wet Chemistry

- Acidity, Free and Total – EPA 305.1
- Alkalinity, Free and Total – EPA 310.1, SM 2320B
- Ammonia Nitrogen – EPA 350.2
- Anion Analysis by IC – EPA 300.1, SM 4110B
- Biochemical Oxygen Demand (BOD) – EPA 405.1, SM 5210B
- Chemical Oxygen Demand (COD) – EPA 410.4, SM 5220
- Chloride – EPA 325.3, SM 4500-Cl-
- Chlorine, Free and Total – EPA 330.5, SM-4500-Cl-G
- Chromium, Hexavalent – EPA 218.6, EPA 1636
- Color – EPA 110.2, SM 2120B
- Conductivity – EPA 120.1
- Cyanide, Total – EPA 335.4
- Dissolved Oxygen (DO) – EPA 360.1, SM 4500-O
- Explosives Analysis – EPA 8330
- Fluoride – EPA 340.2, SM 4500-F-C
- Hardness, Total – EPA 130.2, SM2340C
- Hardness, Calcium – EPA 215.2, SM 3500-Ca
- Microbiological – SPC– SM 9215B
- Moisture – SM 2540C
- Nitrite-Nitrate – EPA 353.1
- Nitrogen, Total Kjeldahl – EPA 351.3
- Non-volatile Residue (NVR) – ASTM F331
- Oil and Grease (n-Hexane Extractable) – EPA 1664B
- Perchlorate – EPA 314.0
- pH – EPA 150.1
- Phenolics – EPA 420.4
- Phosphate, Ortho and Total – EPA 365.3, SM 4500-P
- Silica – EPA 370.1, SM 4500-Si
- Solids – Total, Suspended, Dissolved, Settleable – EPA 160
- Sulfate – EPA 375.4, SM 4500-SO4
- Surfactants – EPA 425.1, SM 5540

- Temperature – EPA 170.1, SM 2550B
- Total Organic Carbon (TOC) – EPA 415.2
- Turbidity – EPA 180.1
- Volatile Content – EPA 160.4
- Water Content (Karl Fischer) – ASTM E1064

### Coatings/Physical Properties Testing

- Abrasion, Taber – ASTM D4060, FED STD 141C, 6192.1
- Adhesion –
  - ‡ Bend to break – ASTM B571
  - ‡ Knife – ASTM D6677
  - ‡ Knife-chisel – ASTM B571
  - ‡ Mandrel – ASTM B571
  - ‡ Pull-off – ASTM D4541, IV & V
  - ‡ Tape test – ASTM D3359
- Atomizer & Water Break – ASTM F22, MIL-C-1359B
- Coating Cure Studies
- Color – ASTM D2244
- Density/Specific Gravity – ASTM D792
- Electrical Conductivity
- Electrochemical Impedance (EIS)/Linear Polarization Testing
- Fastener Testing –
  - ‡ Torque Tension
  - ‡ Run-on Torque
  - ‡ Break-away Torque
- Fiber Content (Composites) – ASTM D3171
- Fluid Immersion – ASTM D1308
- Gloss – ASTM D523
- Hardness –
  - ‡ Barcol – ASTM D2583
  - ‡ Durometer – ASTM D2240
  - ‡ Pencil – ASTM D3363
  - ‡ Scratch – ASTM G171
- Impact/Reverse – ASTM D2794
- MEK Rub – ASTM D4752
- Nondestructive Evals –
  - ‡ Bulk Modulus
  - ‡ Elastic Modulus
  - ‡ Flash Thermography
  - ‡ Poisson's Ratio
  - ‡ Young's Modulus
- Surface Profile/Roughness – ASTM D4417, ASTM D7127
- Thermal Analysis (TGA, DSC)
- Thermal Stability/Shock Studies
- Thickness (Tooke) – ASTM D4138
- Thickness (Nondestructive) – ASTM B244, B499, D1400, D7091
- Voltage Withstand/HIPOT Testing

### Corrosion Testing

- Accelerated Weathering – ASTM G26
- Alternate Immersion – ASTM G44
- ASSET Testing – ASTM G66
- Condensation – ASTM D4585

- Cyclic Corrosion – GMW14872
- EXCO Test – ASTM G34
- Filiform Corrosion – ASTM D2803C
- Humidity – ASTM D1748, D1735
- Filiform Corrosion – ASTM D2803, Procedure C
- Hydrogen Embrittlement – C-rings – ASTM F519
- Modified Salt Fog Testing – ASTM G85, Annex 1, 2, 3, 5
- NAMLT Testing – ASTM G67
- Salt Fog Testing – ASTM B117
- Sandwich Corrosion – ASTM F1110
- Stress Corrosion Cracking – ASTM G64, G58, G47, G49
- Total Immersion Corrosion – ASTM F483
- Ultraviolet (A or B) Condensation – ASTM D4587

### Destructive Testing

- Bend and Flexure Testing – ASTM E290
- Compression Testing – ASTM B312, ASTM B331, ASTM B528, ASTM E9, ASTM E209
- Dynamic Tear Testing – ASTM E604, ASTM E208
- Ductility and Formability Testing
- Fatigue – low cycle, high load
- Fracture Testing – ASTM E643
- Fracture Toughness – ASTM E399, ASTM E1820
- Impact Testing – ASTM E23
- In-Plane Shear – ASTM D3518
- Tension Testing – ASTM E8, ASTM D412, ASTM E21

### Emissions Monitoring

- Acid Gases
- Continuous Emissions Monitoring (CEM) – Hydrocarbons, Carbon Monoxide, Carbon Dioxide, NOx, SOx, Oxygen
- GC Analysis – Light gases & hydrocarbons
- Hand-held Flue Gas Analysis
- Stack Sampling - Metals & Particulates
- Stack Velocity Measurements

### Fuels Analysis

- Appearance – ASTM D4176
- Ash & Sulfated Ash – ASTM D482, ASTM D874
- Autoignition Temp – ASTM E659
- Carbon Residue – ASTM D524
- Cetane Index – ASTM D976
- Characterization & Speciation of Organics & Additives by GC/MS – ASTM D2425
- Color – ASTM D1500, ASTM D156
- Copper Strip Corrosion – ASTM D130
- Demulsification – ASTM D1401
- Density/API Gravity – ASTM D1298
- Distillation Temp – ASTM D86, ASTM D2887
- Doctor Test – ASTM D4952
- Electrical Conductivity – ASTM D2624

- Elemental Analysis - ASTM D5291
- Estimated Boiling Point
- Existent Gum – ASTM D381
- Glycerin – ASTM D6584
- Flash Point – ASTM D93
- Fuel System Icing Inhibitor (FSII) – ASTM D5006
- Gas Range Organics (GRO) & Diesel Range Organics (DRO) – EPA 8015C
- Heat of Combustion – ASTM D240
- Hot Surface Ignition – FED Std 791C
- Hydrocarbon, Aromatic, and Alcohol Analysis – ASTM D1319
- Low Temperature Properties –
  - ‡ Pour Point – ASTM D97
  - ‡ Cloud Point – ASTM D2500
  - ‡ Freeze Point – ASTM D2386
  - ‡ Cold Filter Plugging Point (CFPP) – ASTM D6371
- Lubricity, HFRR, ASTM D6079
- Mercaptan Sulfur – ASTM D3227
- Microbial Growth – ASTM 6469
- Oxidative Stability –
  - ‡ Accelerated – ASTM D2274
  - ‡ Rancimat – EN 14112
- Particulate Matter & Filtration Time – ASTM D5452, D2276
- Percent Biodiesel – App A, A-A-59693A
- pHe – ASTM D6423
- Smoke point – ASTM D1322
- Specific Heat – ASTM E1269
- Storage Stability – ASTM D4625
- Sulfur by XRF – ASTM D4294
- Surface Tension – ASTM D971
- Total Acid Number – ASTM D974, ASTM D664
- Total Base Number – ASTM D4739
- Trace Metals – UOP 389, ASTM D7111
- Vapor Pressure, Reid – ASTM D323
- Viscosity – ASTM D445
- Water Content – ASTM D2709
- Water Reaction Interface Rating – ASTM D1094
- Water Separation Index – ASTM D3948

### Materials Compatibility

- Various substrates and methods
- Programs developed in-house

### Metallurgical Analysis

- Energy Dispersive Spectrometry (EDS)
- Hardness Testing – ASTM E18, ASTM E384
- Image Analysis – ASTM E45, ASTM E112, ASTM E1122, ASTM E1245
- Microhardness Testing – ASTM B578
- Nanohardness Testing
- Optical Microscopy
- Sample Preparation
- Scanning Electron Microscopy (SEM)

### Test Method Development