



Catalysis Toolbox

- **Reaction experiments (micro or lab-scale reactors)**
 - Activity/selectivity
 - Kinetic parameters
 - Deactivation characteristics
 - Mechanistic studies
- **Physical characterization**
 - Surface area
 - Pore volume / pore size distribution
 - Dispersion
 - Particle size
- **Microscopy (SEM, TEM)**
 - Particle size / shape
 - Dispersion
 - Composition
 - Surface morphology
- **Surface characterization**
 - X-ray Photoelectron Spectroscopy (XPS)
 - Secondary Ion Mass Spectroscopy (SIMS)
 - Auger-Electron Spectroscopy (AES)
- **Bulk and structural characterization**
 - X-ray Diffraction (XRD)
 - X-ray Fluorescence (XRF)
 - Energy Dispersive X-ray Analysis (EDXA)
- **Molecular and in-situ characterization**
 - Laser Raman Spectroscopy (LRS)
 - Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS)
 - Nuclear Magnetic Resonance (NMR)
 - Electron-spin Resonance (ESR)
- **Adsorption/desorption characterization**
 - Temperature Programmed Reduction (TPR)
 - Temperature Programmed Oxidation (TPO)
 - Temperature Programmed Desorption (TPD)
- **Thermal analysis**
 - Thermo-gravimetric Analysis (TGA)
 - Differential Thermal Analysis (DTA)
 - Differential Scanning Calorimetry (DSC)