

# Small-angle X-ray Scattering Characterization of Nanostructured Catalysts

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SAXS/GISAXS is a well established and widely used nondestructive technique for the characterization of non-crystalline or partly ordered materials. SAXS/GISAXS can provide unique structural information on the shape, size, and dynamic change of catalytic nanoparticles in the size range between one and a few hundred nm at nanometer scale resolution in reaction condition.

Several examples of rapidly evolving research areas including novel catalysis synthesis and in-situ real time characterization of nanostructured material will be presented to highlight the capabilities of the SAXS and GISAXS techniques on heterogeneous catalysis application.

1. Sub-nanometer to nanometer scale metal nanoparticles prepared by ALD (atomic layer deposition) and cluster ion beam deposition were used as a model catalyst system. *In situ* SAXS/GISAXS were performed to monitor size and structure change during the reaction condition.
2. MOFs (Metal–organic frameworks) and nanobowls prepared by selective ALD are promising tailored catalysts templates. Nano-structured single site heterogeneous catalyst templates were prepared by selective ALD and MOFs and were studied by SAXS to reveal their structural details including nanostructure formation, structural uniformity and spatial isolation of synthesized materials.