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Probing Structural Changes in Nanoparticles During CO-Oxidation Reaction via *in situ* TEM

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Nanoparticle catalysts are commonly used to accelerate chemical reactions and increase the efficiency of a broad range of industrially relevant reactions. To enable the rational design of catalysts with better performance, it is critical that we understand the relationship between a nanoparticle's structure and its catalytic properties. However, because the nanocatalysts exhibit dynamical structures that do not exist outside the reactive environment, such insights about catalysts must be obtained under reaction conditions. TEM has always been a powerful technique for studying the detailed structure of nanoparticles. Recent developments in *in situ* environmental TEM, now allow us to study nanostructures within a gas environment with TEM, and probe their dynamics in a reactive environment.

Using in situ gas-phase TEM imaging, I will discuss how nanoparticle catalysts behave during catalysis and identify transient active states responsible for reactions. Specifically, using monometallic and bimetallic nanoparticles for CO oxidation model reaction, I will describe surprising permanent and transient structural transformations that drive CO-oxidation reaction.

These insights into how nanoparticle catalysts evolve during catalysis are important for the rational design of high-performance catalysts.