SINGLE-MOLECULE MICROSCOPY OF NANOCATALYSIS

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Nanoparticles are important catalysts. Understanding their structure-activity correlation is paramount for developing better catalysts, but hampered by their inherent inhomogeneity: individual nanoparticles differ from one to another, and for every nanoparticle, it can change from time to time, especially during catalysis. Furthermore, each nanoparticle presents on its surface various types of sites, which are often unequal in catalytic activity. I will present our work of using single-molecule fluorescence microscopy to overcome these challenges and study single-nanoparticle catalysis at the single-turnover resolution and nanometer precision. I will present how we interrogate the catalytic activity and dynamics of individual metal nanoparticles, map the reactivity of different surface sites, and uncover surprising spatial reactivity patterns within single facets at the nanoscale. This spatiotemporally resolved catalysis mapping also enables us to probe the communication between catalytic reactions at different locations on a single nanocatalyst, in much relation to allosteric effects in enzymes.