

Alternative local melting solidification of suspended nanoparticles for heterostructure formation enabled by pulsed laser irradiation

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This presentation, which is prepared upon the invitation from Advisory Committee of the ISSRNS'2025 due to the PTPS Award for the article with the same title, explores the use of pulsed laser irradiation of colloidal nanoparticles as an innovative method for synthesizing submicron heterostructure particles. The process involves irradiating transition metals and their oxides, where physical perturbations in the colloidal environment drive chemical phase formation, resulting in variable oxidation states and highly active surfaces [1, 2]. These unique properties make the synthesized particles exceptionally suited for surface-dependent applications such as catalysis. The talk will highlight experimental findings, focusing on how microstructural transformations can be controlled by tuning synthesis parameters. Insights into oxidation state variations will be presented, with a particular emphasis on synchrotron-based characterization techniques (Fig. 1). Additionally, theoretical support through ab-initio subatomic calculations and atomistic simulations will be discussed, providing a deeper understanding of the experimental observations [3]. In the concluding section, the application of the synthesized heterostructures in ethanol oxidation reactions within electrocatalytic fuel cells will be addressed, showcasing their potential in renewable energy technologies.

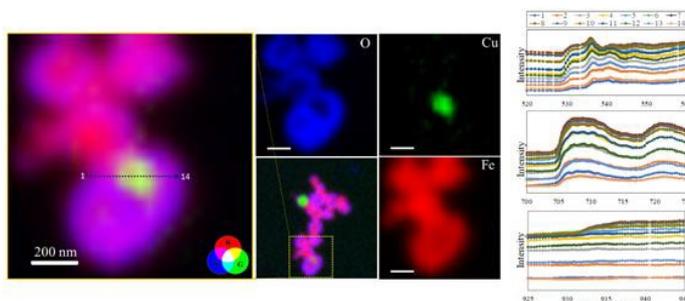


Fig. 1. Local oxidation state analysis of phase formation during pulsed laser irradiation

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