

## Laser-Induced Transition Metal-Based Composite Particle Formation in Liquid: Insight in Physico-Chemical Processes

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Pulsed laser irradiation in liquids is a versatile and promising method for synthesis of colloidal submicrometer spheres are particularly attractive for bio-sensing, medical application, lithium-ion batteries (LIBs), catalysis, and photonics. Composite particles based on transition metal (Fe, Co, Ni) are successfully produced and tailoring by using laser method with various experimental parameters; wavelengths, laser fluence, irradiation time, raw material or solvent. The mechanisms involved in the formation of these particles are, however, still under consideration.

Here, we focus our attention at the better understanding of the physical and chemical processes occupied in particles formation by pulsed laser irradiation in liquids. For this, a series of both experimental and numerical studies were performed. In particular, by using various experimental parameters composite particles with different size and composition were obtained. The structure, phase composition, size, morphology and magnetic properties were confirmed by XRD, TEM, EDS, SEM and SQUID.

Figure 1 illustrates XRD and SEM results of obtained two-component particles among Fe, Co and Ni. Submicrometer spherical particles are generated. XRD patterns clearly show that laser irradiation of (Fe, Co, Ni)-oxides nanoparticles dispersed in ethanol leads to reduction of oxides and formation of alloys (FeCo, NiCo, FeNi). Furthermore, the role of the solution, liquid properties, interaction not only between particles but also between particles and solvent molecules was demonstrated. The detailed discussion will be reported at the conference. By

exploring the formation mechanism, roles of physico-chemical effects in the particle formation will help in creation of materials with specific size, structures and unique properties.

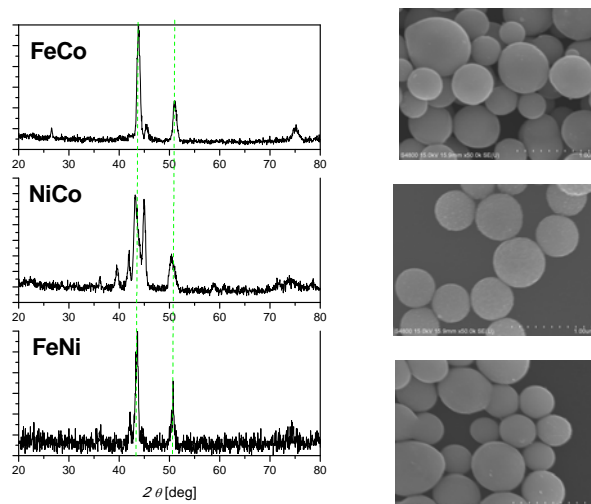


Fig.1 Typical XRD patterns and SEM images of transition metals nanocomposite particles obtained by pulsed laser irradiation in ethanol (355nm, 177 mJ/pulse·cm<sup>2</sup>, 1h)