
Redox-induced precipitation of nickel and cobalt metal nano-particles in silicate glasses

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Abstract

Optical and magnetic properties of transition metal nanoparticles (Co, Ni, Fe) in oxide glasses are currently receiving attention for potential applications in data storage and as magnetic resonance contrast media. The glass matrix thereby acts as a stabilizer preventing metal oxidation as well as agglomeration of the particles. As the particle size plays a significant role for the material properties, controlling growth rate and final size distribution is a prerequisite for future applications. The time-dependent size evolution of Ni and Co metal nanoparticles is therefore studied in borosilicate base glasses. To trigger redox-induced precipitation, the glasses were treated under a hydrogen stream while running a defined time-temperature protocol. Particle size distributions were determined on small scales by analysis of electron microscopy (TEM, SEM) images, whereas UV-Vis-NIR spectroscopy was used to identify mean particle sizes of Ni and Co nano-particles.

Keywords: Reduction, Nanoparticles, Kinetics, Cobalt, Nickel

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