

# Chemical Engineering: From Materials Engineering to Nanotechnology

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## Preparation of nanosized particles for Group IB and Group VIII transition metals by chemical reduction in solution

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In the presence work, chemical reduction by electroless deposition technique as a method belonged to the bottom up approach of synthesis for a nanosized particles is used for producing a uniform shape and size metallic nanoparticles. A number of metals can be reduced to the metallic state from solutions of their salts by chemical means. These are of group IB such as, silver and copper and of group VIII such as iron, nickel, cobalt, Platinum and palladium. in the elemental form bimetallic form or in the alloyed form. Metals and alloys as submicron size and nanoized particles structures including Pt, Pd, Ag, Cu and Ni as well as Pt-Ni, Fe-Ni, Ni-Co and Fe-Co bimetals or alloys were prepared. by chemical reduction in aqueous solutions. Although the techniques have been used to produce precious metal powders, the ease of chemical reduction from solution and the variety of powders that can be prepared make this aqueous processing technique the preferred approach to build up homogeneous nanoparticles. Chemical precipitation of metal from a solution of soluble salt is used, such as silver and copper particles of which is produced by adding a reducing agent such as formaldehyde to a solution of silver or copper ions. Although many

reducing agents are available, those most commonly used to reduce the ions for the metals of group IB and VIII are hypophosphite, borohydride, hydrazine, polyols and aldehydes. Different types of complexing agents were used as a chelating agent for the metals in the bath to prevent hydroxide precipitations as citrates, oxalates, acetates and tartrates. The results reveled that, it is possible to produce nanoparticles consisting of one or more metal with different morphology by appropriate adjustment of the chemistry of the reduction solution. Synthesis of nanosized bimetallics or alloy are also taking place. Studies of the deposition of nickel with other metals such as Pt, Co or Fe were showed that the produced particles are highly homogeneous. The particle size and morphology investigations were performed by SEM, TEM and EDAX analysis. XRD was performed for the investigated particles to identify the chemical composition of the produced particles. The magnetic properties of the obtained particles were investigated by the vibrating sample magnetometer method.

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