SYNTHESIS AND CHARACTERIZATION OF PALLADIUM NANOPARTICLES FOR CATALYTIC APPLICATIONS

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There has been considerable interest in the field of nanoscale-material fabrication due to the unusual chemical and physical properties as well as novel technological applications, that often observed compared to its corresponding bulk materials. Of particular importance is the formation of noble metal nanoparticles, because they show unique performance for catalyzing, for instance, photogeneration of hydrogen from water, hydrogenation of olefins and dienes and reduction of CO_2. Such nanoparticles can be prepared through various techniques including; gas evaporation, coprecipitation, sol-gel, hydrothermal and microemulsion method. However, to date there are some challenges to achieve a desired size of nanoparticles and to control the uniformity and distribution.

In this study, we report a simple wet chemical method to synthesize palladium nanoparticles. The technique is based on the chemical reduction (in solution) of the palladium salt. A mixture of ethylene glycol and alkaline hydroxide ions is indispensable to initiate the reduction process and catalyze the reaction. We added also a polyvinylpyrrolidone (PVP) as a protective agent to isolate the nanoparticles and prevent the agglomeration. The crystallinity, size and morphology, and structural features of the produced nanoparticles are investigated by powder x-ray diffraction (XRD), transmission electron microscopy (TEM). The performance of the nanoparticles as a catalyst for electroless deposition of copper on both silicon and epoxy substrates is also presented. Fine and monodispersed Pd nanoparticles with average particle size ~ 8 nm are obtained at a certain concentration of NaOH (0.3 M). The resulting nanoparticles were found to be very useful and efficient in catalyzing the electroless deposition of Cu onto both silicon and epoxy substrates, which is an essential process in the printed circuit board industry.

Keywords: Pd nanoparticles; Catalytic application; Electroless Cu deposition