1990
doi:10.1017/S1431927619010687
Microsc. Microanal. 25 (Suppl 2), 2019

Structure and Morphology Study of Copper/Copper Oxides Nanoparticles

LA Hermida-Montero[1], Nicolaza Pariona[2], Arturo I. Mtz-Enriquez[3] and F Paraguay-Delgado[1*]

[1.] Centro de Investigación en Materiales Avanzados SC (CIMAV), Laboratorio Nacional de Nanotecnología, Miguel de Cervantes No. 120, Chihuahua, Chih. México.
[2.] Red de Estudios Moleculares Avanzados, Instituto de Ecología A.C., Carretera Antigua a Coatepec 351, El Haya, Xalapa, Veracruz, México.
[3.] Centro de Investigación y de Estudios Avanzados del IPN Unidad Saltillo, Av. Industria Metalúrgica 1062, Parque Industrial Ramos Arizpe, Coahuila, México.
* Corresponding author: Francisco.paraguay@cimav.edu.mx

Nanoparticles have great attention due to its peculiar properties. Copper and copper oxide NPs (Cu/Cu_xO-NPs) are of interest due to their low cost and their relatively high physical and chemical stability. These particles have antifungal properties [1] but it is necesary to optimize low and effective doses. At this time, there is a disscusion about it antifungal activity, due to the literature still discuss about the oxidation state of copper [2]. However, besides the oxidation state of copper, the size and morphology of the NPs play important role in the antifungal effect. An adequate choice of the copper NPs properties, such as the oxidation state, size, etc. can improve their antifungal activity. In this work, by means of TEM and XRD was studied different morphologies and compounds.

Copper and copper oxide nanoparticles were synthesized by an eco-friendly method. 50 mL of $CuCl_2 \cdot 2H_2O$ (0.1 M) was mixed with 50 mL of PEG 8000 (0.038 M). Then, under stirring 50 mL aqueous solution of ascorbic acid (0.2 M) mixed with NaOH (1 M) was added. Afterward, 50 mL of $NaBH_4$ solution at different concentrations (0.1, 0.5, 1, 1.45 M) were added. The reaction was stirred at room temperature for 30 min at open atmosphere. After this time, a precipitate brown dark color is formed, which indicates the formation of the Cu/Cu_xO nanoparticles. The obtained samples were named according to different $NaBH_4$/Cu(II) molar ratios. Morphology and structure changes was studied by TEM and XRD techniques.

Fig. 1 shows the morphology change of as synthesized nanoparticles. For NP1 the size of the particles is small, round shape (Cu_2O) and truncated octahedrons (Cu) are observed (Fig. 1a). On the other hand, the NP2 samples showed small round particles corresponding to CuO, bigger truncated octahedrons (Cu), and some laminated particles, which correspond to CuO (Fig. 1b). For the NP3 small round (Cu) and laminated (CuO) particles are observed (Fig. 1c). For NP4, there is only laminated particles (CuO) observed (Fig. 1d). From these images, could be conclude that the concentration of $NaBH_4$ in the synthesis also controls the morphology and size. Table 1 shows the crystal size and compound percentage content for each synthesis, determine from Rietvel refinement of X-ray diffraction patterns [3].

References:

[1] G Borkow and J Gabbay, Curr. Chem. Biol. **3** (2009), p. 272.
[2] A Ananth et al., Chem. Eng. J. **262** (2015), p. 179.
[3] This work was supported by the research project FORDECYT 292399.

	Cu		Cu_2O		CuO	
Sample	Grain size (nm)	%	Grain size (nm)	%	Grain size (nm)	%
NP1	30	19.7	42	80.3	-	-
NP2	14	37.0	22	36.0	17	27.0
NP3	16	12.0	-	-	13	87.0
NP4	22	2.7	-	-	13	97.3

Table 1. Size of the crystallites and composition obtained from Rietveld refinement

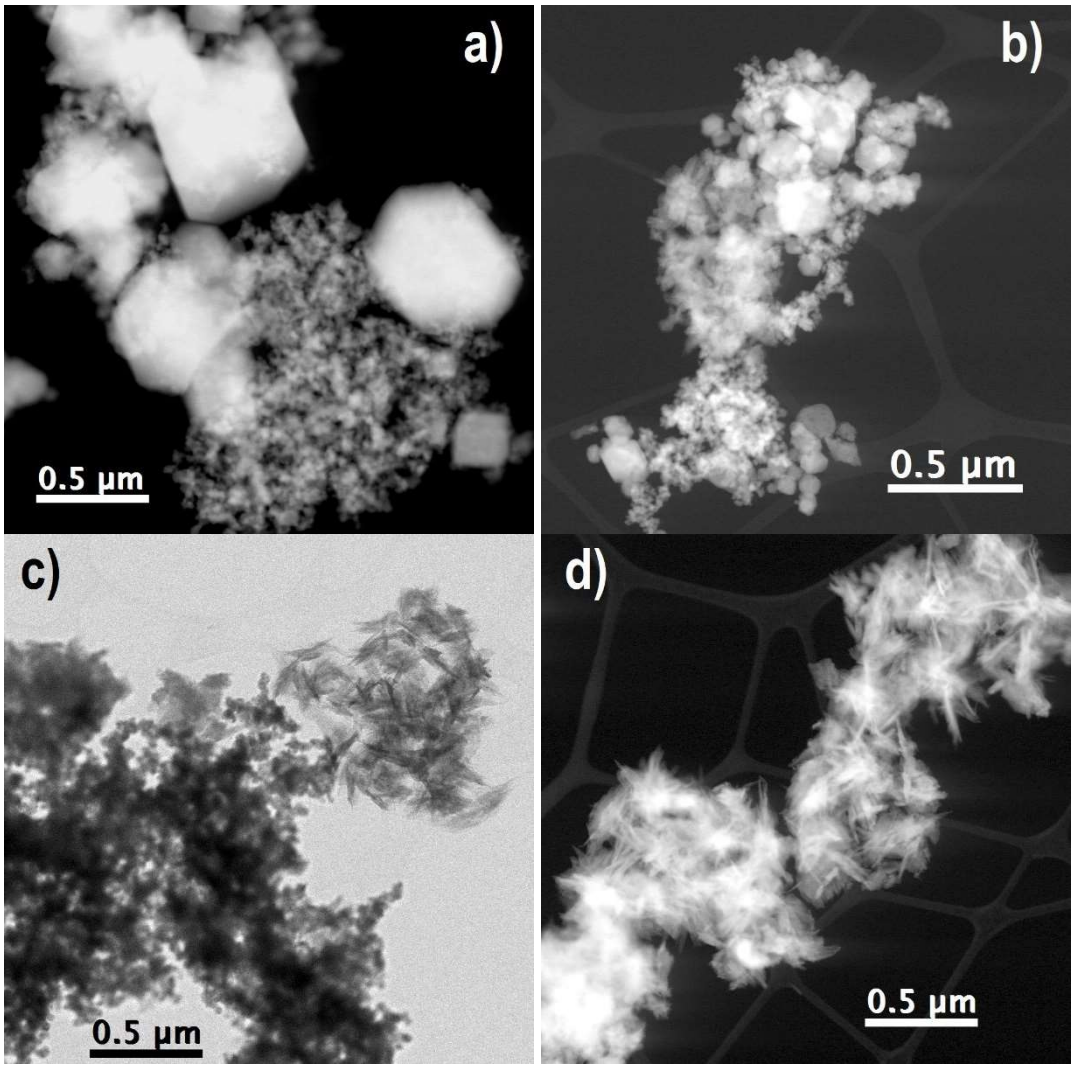

Figure 1. Copper and copper oxide nanoparticles a)NP1, b)NP2, c)NP3 and d)NP4.

https://doi.org/10.1017/S1431927619010687 Published online by Cambridge University Press