

Studying the evolution in time of bimetallic nanoparticles morphology by Cyclic Voltammetry

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Over the last decades, bimetallic nanosized systems have attracted more and more interest thanks to their novel optical, catalytic, magnetic, and sensing properties, often different from the ones of their monometallic counterparts. Studies directed towards the size, shape, composition, and functionalization of the bimetallic nanoparticles are optimized to design sophisticated materials for the intended applications. Considering these facts, it is important to evaluate not only the type and the quantity of the two metals involved, but also their morphological distribution (e.g. alloy or core-shell). Characterization techniques normally used to investigate bimetallic systems are HR-TEM and EXAFS, very expensive and not so easily accessible. Recently, electrochemistry has been employed as alternative or complementary, low-cost, efficient technique with very promising results [1-3], allowing the discrimination between alloyed and perfect or defective core-shell systems after their synthesis. A further achievement is the possibility to follow step by step the formation morphology of these nanomaterials during their synthetic procedure. In the present work, we present a study on Au-Pt bimetallic nanoparticles, in form of alloy or core-shell. Cyclovoltammetry (CV) is used as a fast, low-cost and simple screening technique to distinguish the general composition of the sample and to understand the evolution in time of the systems morphology during their synthesis. An additional advantage is the possibility to conduct the study of the material simply in liquid form, without the need of using solid supports, as normally required by other characterization techniques. Interesting results are obtained for Au-based bimetallic samples, gaining information in accordance with TEM images and EXAFS spectra. This fact moves the interest towards the study of other bimetallic systems, to be used in catalytic, electrocatalytic and electroanalytical applications.

[1] L. R. Holt, B.J. Plowman, N.P. Young, K. Tschulik, R.G. Compton, *Angew. Chem. Int. Ed.*, **2016**, 55, 397–400.

[2] K. Tschulik, K. Ngamchuea, C. Ziegler, M.G. Beier, C. Damm, A. Eychmueller, R.G. Compton, *Adv. Funct. Mater.*, **2015**, 25, 5149–5158.

[3] V. Pifferi, C. Chan-Thaw, S. Campisi, A. Testolin, A. Villa, L. Falciola, L. Prati, *Molecules*, **2016**, 21, 261.

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