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Synthesis of non-spherical metal nanoparticles for ultra-sensitive SERS

Non-spherical metal nanoparticles (NPs) are promising platforms for ultra-sensitive detection using Surface Enhanced Raman Spectroscopy (SERS). In comparison with the more common spherical NPs, non-spherical NPs have the advantage of a higher number of *hot spots*, i.e. sites at the surface of the NP where the strong enhancement of the local electromagnetic field causes amplification of the usually weak Raman signal of species in close vicinity. [1] Nevertheless, the use of non-spherical NPs in SERS has been hampered by several problems related to the NPs, namely the need of strongly adsorbed capping agents in the synthesis, that block the adsorption of the analyte at the *hot spots*, and poor reproducibility and uniformity.

We have adapted or developed new synthetic procedures to prepare non-spherical silver NPs, using capping agents that can be easily exchanged with the analyte. We have synthesized silver and gold nanostars, nanotriangles, nanorods, and microdendrites (Figure 1). [2,3] SERS performance of the NPs was evaluated by deposition on glass and paper followed by measurement of signal enhancement using rhodamine 6G as a probe. Average enhancement factors of 10^7 were obtained for silver nanostars, with good reproducibility and uniformity, indicating that this simple approach can be successfully implemented as a low-cost platform for SERS detection. [4] Studies are in progress envolving analytes of environmental and/or biological relevance.

References

[1] P. Quaresma, I. Osório, G. Dória, P. A. Carvalho, A. M. Pereira, J. Langer, J. P. Araújo, I. Pastoriza-Santos, L. M. Liz-Marzán, R. Franco, P. V. Baptista, E. Pereira, RSC Adv. 4(2014) 3659-3667

[2] Y. Song, Y. Yang, C. J. Medforth, E.Pereira, A. K. Singh, H. Xu, Y. Jiang, C. J. Brinker, F. van Swol, J. A. Shelnutt, J. Am. Chem. Soc. 126(2004) 635-645

[3] A. Miranda, E. Malheiro, E. Skiba, P. Quaresma, P. A. Carvalho, P. Eaton, B. Castro, J. A. Shelnutt, E. Pereira, Nanoscale 2(2010) 2209-2216

[4] M. J. Oliveira, P. Quaresma, M. P. Almeida, A. Araújo, E. Pereira, E. Fortunato, R. Martins, R. Franco, J. Mater. Chem. C, submitted.

Figures

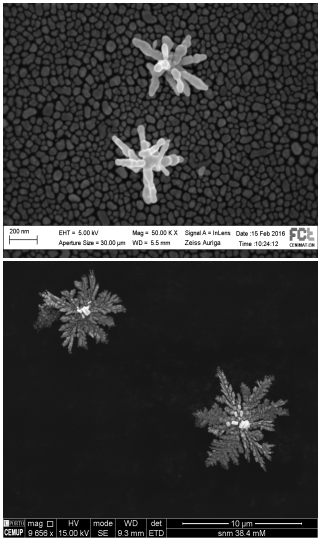

Figure 1: SEM images of silver nanostars (top) and silver microdendrites (bottom).