Self-assembled monolayers of gold nanocrystals as sensitive substrates for surface enhanced Raman spectroscopy

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To date, the most popular approach for SERS detection of molecules rests on the use of colloidal metal nanoparticles deposited on glass or silicon substrates or randomly aggregated within salts-containing solutions: the 'hot spots' created at the gaps and junctions between two or multiple adjacent nanoparticles are at the basis of an amplified Raman signal. However, control over the hot spot distribution within these systems is intrinsically challenging, conferring scarce reproducibility and accuracy. Here we propose a new approach based on superstructures consisting of bidimensional arrays of gold concave nanocubes (CNCs), including a regular distribution of hot spots for molecular detection [1,2]. CNCs are closely-packed through face–face and face–corner interactions generating a monolayered arrangement featuring well distributed nanoholes. Here the target species homogeneously experiences an E-field enhancement outward from the metal surfaces surrounding it, which causes a large number of vibrations to be contemporarily amplified. The proposed platform provides stable and detailed SERS spectra and confers rapidity and reproducibility to the analysis.

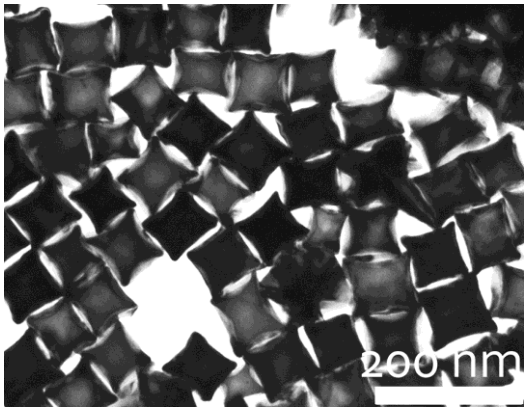

Fig.1 TEM image of a representative nanoparticles array.

References

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2. Matteini, P., Ratto, F., Rossi, F., de Angelis, M., Cavigli, L. and Pini, R., "Hybrid nanocomposite films for laser-activated tissue bonding," *J Biophotonics* **5**, 868-877 (2012).