Electronic Supplementary Information

Fulleropyrrolidine-functionalized ceria nanoparticles as a tethered dual nanosystem with improved antioxidant properties

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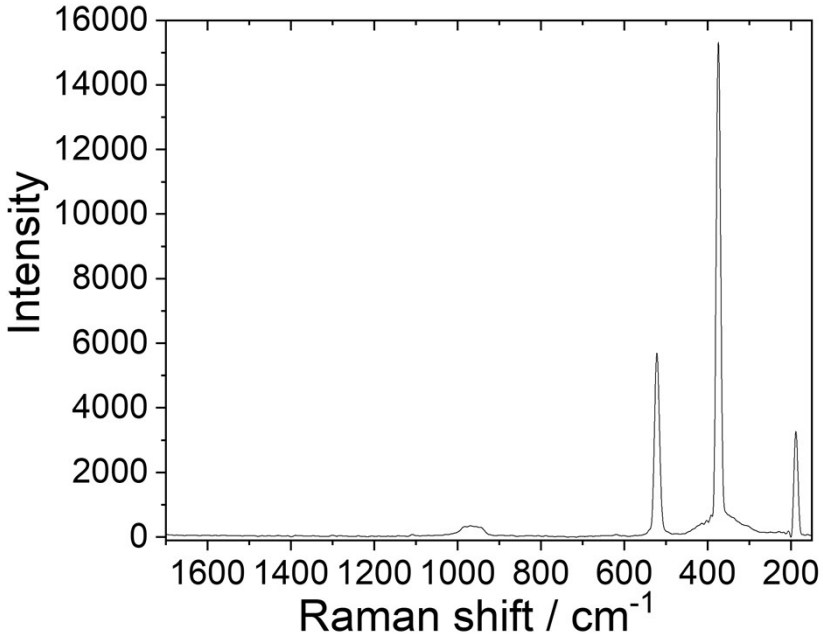

Fig. S1. Raman spectrum of silicon wafer.

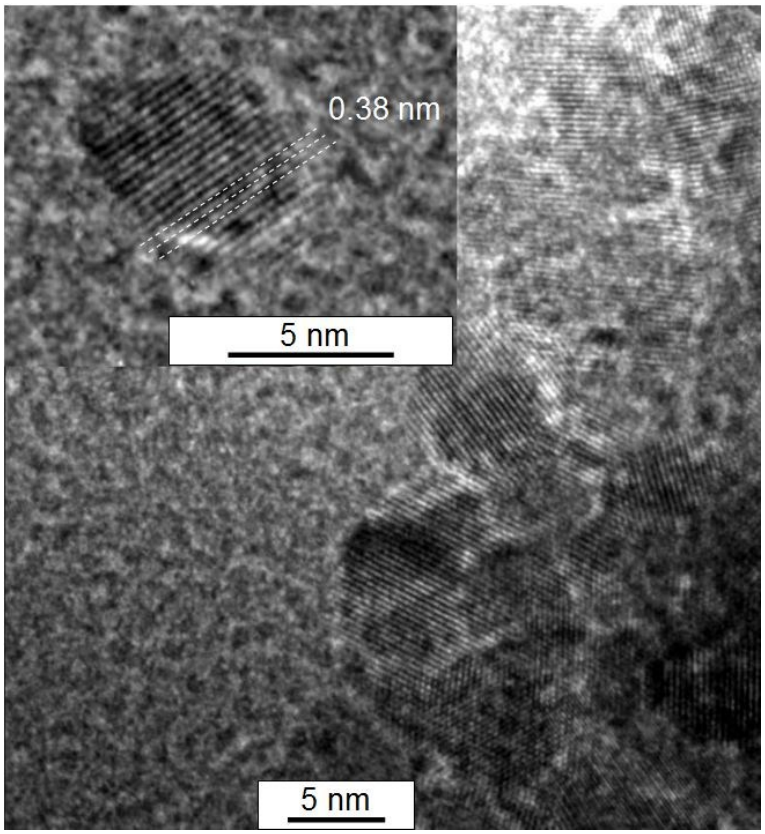

Figure S2. TEM images of CeO_2 nanoparticles. The inset shows a single nanoparticle with lattice fringes of 0.38 nm spacing.

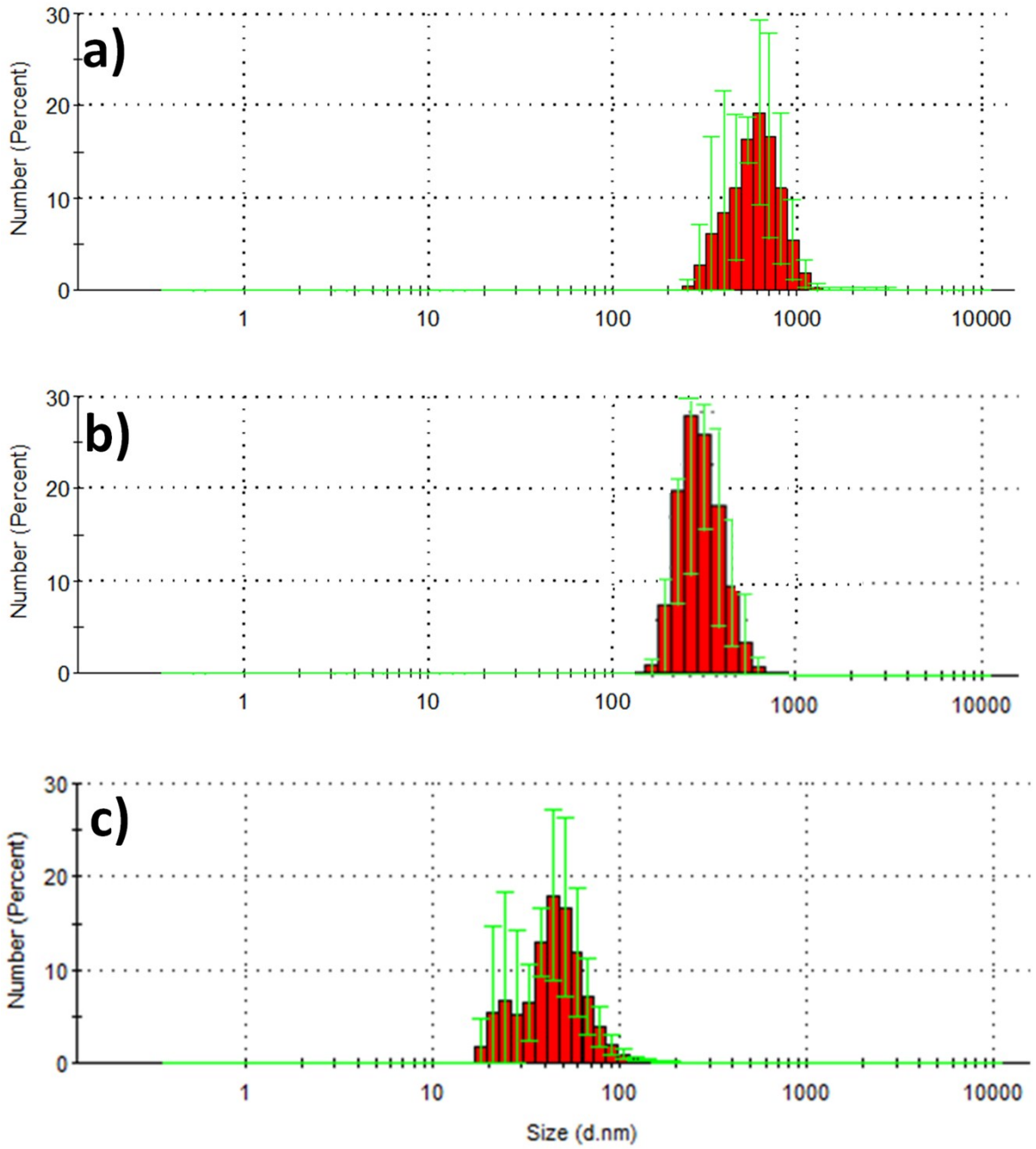

Fig. S3. Dynamic light scattering of: a) Si-Fulp/ceria, b) Si-Fulp and c) ceria in ethanol.

Weight percentage of Si-Fulp in the dual nanosystem

The weight% of Si-Fulp in Si-Fulp/ceria has been calculated considering that the weight losses of ceria nanoparticles and fullerene-derivative are 8 and 46%, these ratios are assumed to be constant in the dual nanosystem. Then, considering the initial weight of Si-Fulp/ceria e the weigth loss after TGA we have solved the two equations

(1) $W_{CeO2} + W_{FS} = 36.72$ mg (weight of Si-Fulp/ceria before TGA)

(2) $0.92\ W_{CeO2} + 0.54\ W_{FS} = 33.13$ mg (weight of Si-Fulp/ceria after TGA)

obtaining the following values:

(3) $W_{CeO2} = 35.00$ mg

(4) $W_{Si\text{-}Fulp} = 1.72$ mg

Therefore the percentage weight ratios of nanoceria and Si-Fulp have been estimated as

(5) $W_{CeO2} / W_{Si\text{-}Fulp/ceria}\,\% = 95.3\%$

(6) $W_{Si\text{-}Fulp} / W_{Si\text{-}Fulp/ceria}\,\% = 4.7\%$

Ratio of Si-Fulp molecules with respect to ceria nanoparticles

Starting from the weight of CeO_2 and fullerensilile in the Si-Fulp/ceria, we have calculated the number of ceria nanoparticles in 36.72 mg of nanostystem. We have assumed that the nanoparticles are spherical with a diametre of 7 nm and therefore a volume of 0.179 10^{-24} m^3. The density of fluorite (the crystalline phase of the ceria nanoparticles) is 7.65 g/cm^3 which gives the volume of the 35 mg of CeO_2 in the nanosystem as 4.576 10^{-9} m^3. From the overal volume of the CeO_2, we have calculated the number of nanoparticles as:

(7) $$\#_{nanop} = \frac{4.576\hat{a}\hat{}\text{™}10^{-9}}{0.179\hat{a}\hat{}\text{™}10^{-24}} = 2.556\hat{a}\hat{}\text{™}10^{16}$$

The number of Si-Fulp molecules has been calculated as:

(8) $$\#_{Si-Fulp} = \frac{W_{Si-Fulp}\ \hat{a}\hat{}\text{™}\ N_A}{MW_{Si-Fulp}} = \frac{1.72\hat{a}\hat{}\text{™}10^{-3}\tilde{A}\text{—}6.022\hat{a}\hat{}\text{™}10^{23}}{1026.07} = 1.009\hat{a}\hat{}\text{™}10^{18}$$

Finally the ratio *R* between $\#_{Si\text{-}Fulp}$ and $\#_{CeO2}$ has been obtained with the following formula:

(9) $$R = \frac{\#_{Si-Fulp}}{\#_{nanop}} = \frac{1.009\hat{a}\hat{}\text{™}10^{18}}{2.556\hat{a}\hat{}\text{™}10^{16}} = 39.475\hat{a}\%_0\hat{}39.5$$

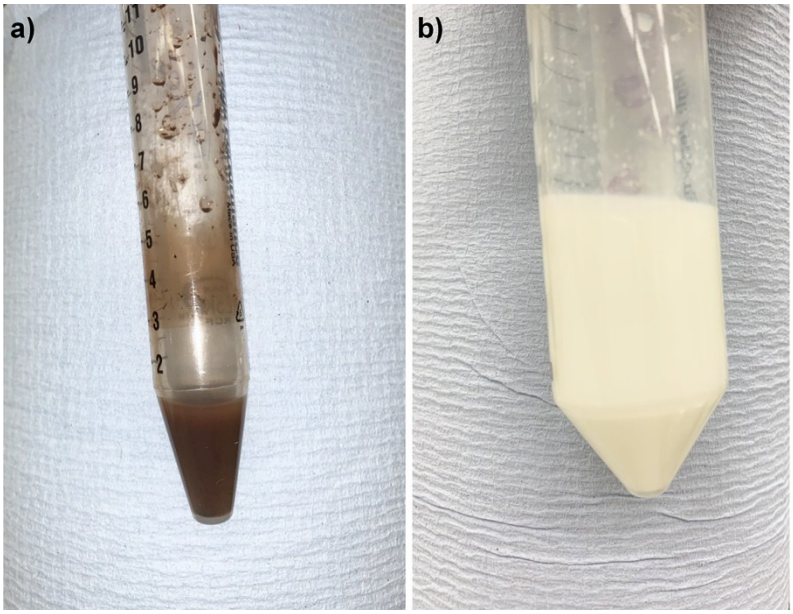

Fig. S4. Pictures of a) Si-Fulp/ceria and b) ceria solution after 3 months from the synthesis

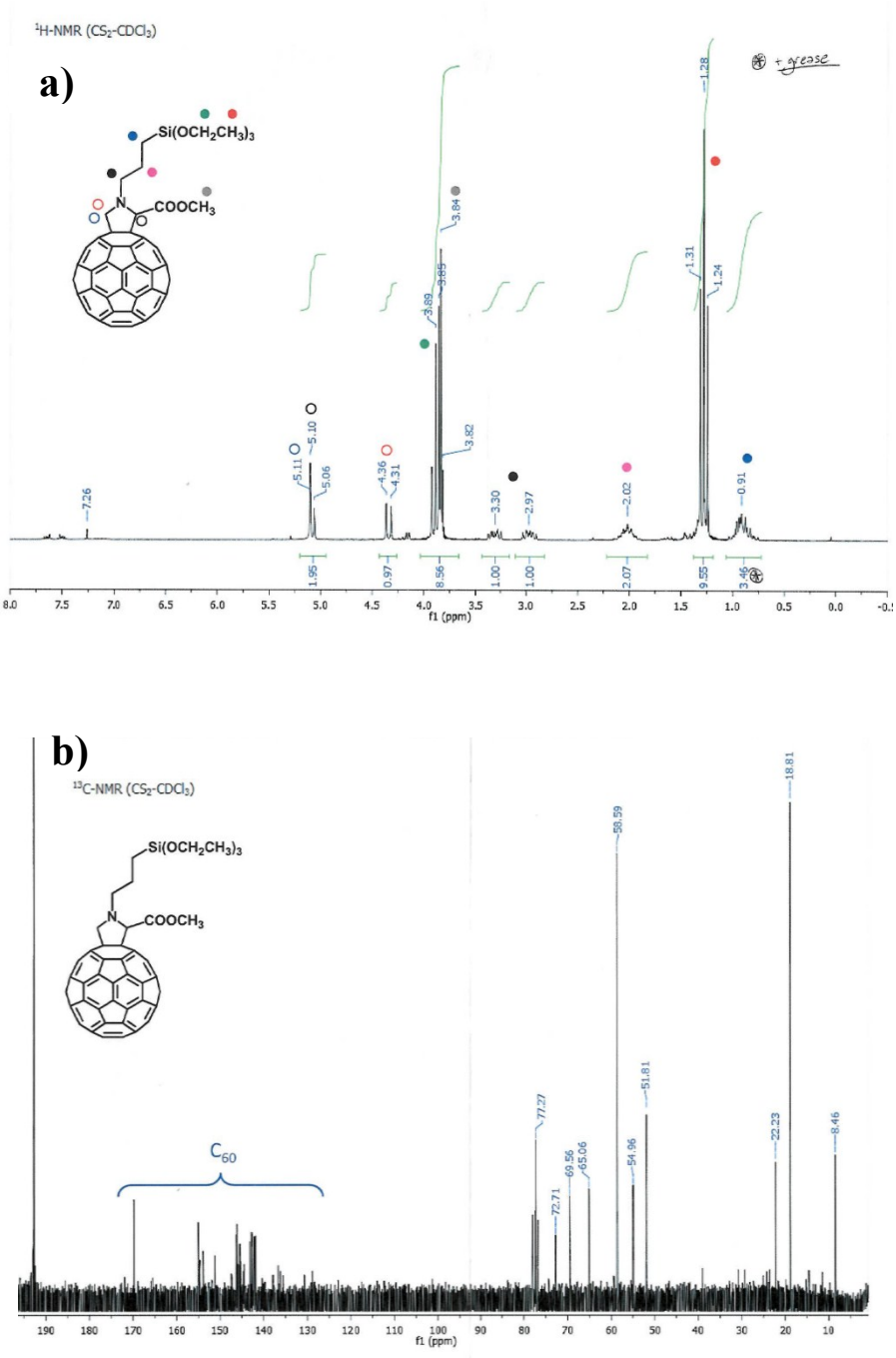

Fig. S5. ^{1}H and ^{13}C of fulleropyrrolidine (a and b respectively). The experimental conditions of the measure are reported in A. Bianco et al. *J. Am. Chem. Soc.* **1997**, *119*, 7550.

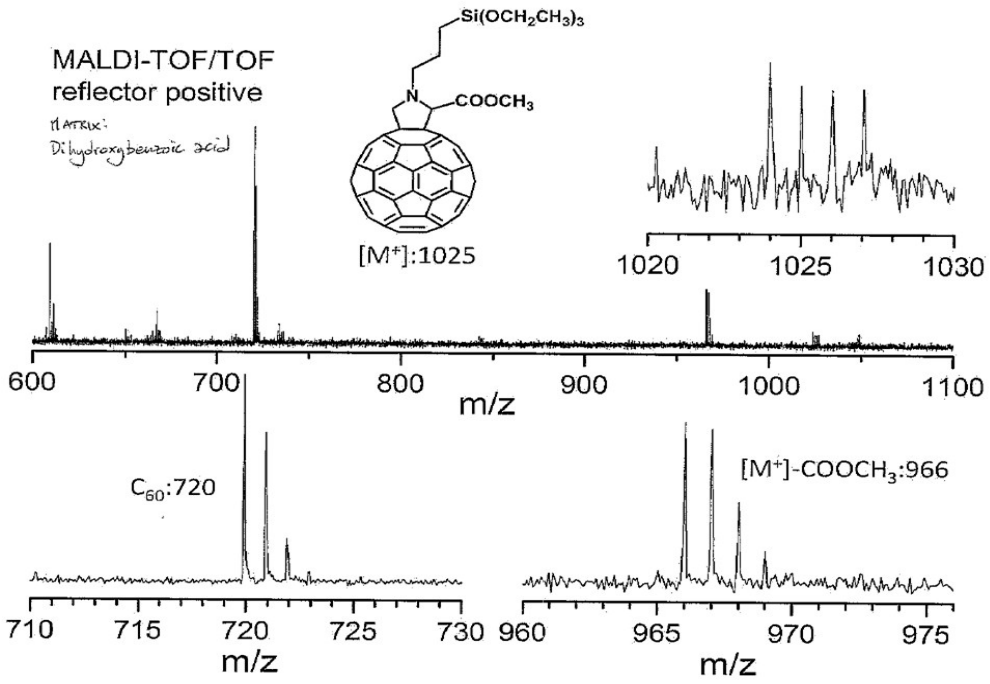

Fig. S6. MALDI-TOF of the fulleropyrrolidine. The experimental conditions of the measure are reported in A. Bianco et al. *J. Am. Chem. Soc.* **1997**, *119*, 7550.