Thermooptical Properties of Branched Gold Nanoparticles Unraveled by In situ EXAFS

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Gold nanoparticles (Au NPs) have immense potential for biomedical applications due to their localized surface plasmon resonance (LSPR) enhanced light absorption. Under optical illumination they efficiently convert the strongly absorbed light into localized heat, which can be exploited for the selective laser photothermal therapy of cancer [1]. Notwithstanding the successful initial demonstrations of the use of immunotargeted Au NPs in hyperthermia therapy, a number of parameters and thermooptical properties need to be better understood and optimized [2]. As most of the temperature evaluations at the surface of NPs are still based on theoretical calculations involving numerous assumptions, the experimental determination of the actual NP temperature increase appears to be a crucial objective for current applications of heated NPs in nanomedicine [3]. Branched Au NPs featuring a very promising hyperthermia potential due to their strong LSPR [4] have been investigated with *in situ* extended X-ray absorption spectroscopy (EXAFS) under illumination with a wavelength close to their plasmon frequency. The individual NP temperature could be measured experimentally in remarkable agreement with the NP suspension temperature measured with a thermocouple located next to the laser beam. Concomitantly, a strong NP concentration variation has been clearly observed and quantified, showing that the heating process originates from a complex interaction of parameters.

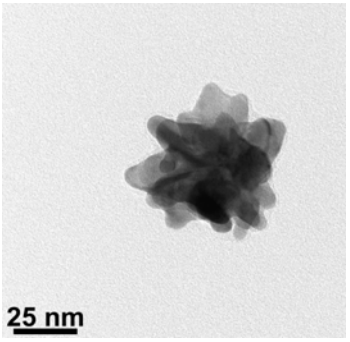

Figure 1: TEM image of a branched Au NP.

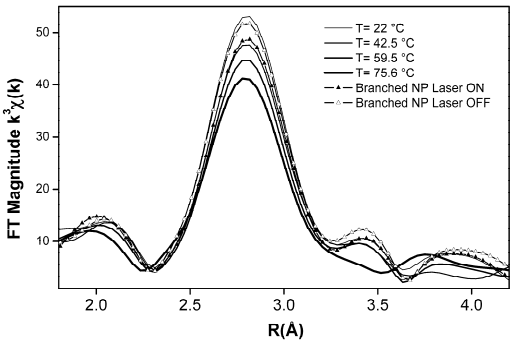

Figure 2: Fourier transforms of the Au L3-edge EXAFS of the Au NPs during calibration and laser test.

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