nanoTBtech webinars

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# Standardization of light-to-heat conversion efficiency of colloidal nanoheaters.

**Abstract:**

One of the most important properties of nanoparticles dedicated to localized hyperthermia of cancer tissues is the efficiency of stimulus-to-heat conversion. For light-based therapies for example, light-to-heat conversion efficiency enables to quantify, rank and optimize various nanoheaters. A few optical systems and methodologies have been proposed to quantify and evaluate the light-to-heat conversion efficiency. Nevertheless, the studies carried so far remain confusing, because whole span of values, from <10% [1] up to 100% [2] were obtained for very similar materials (e.g.~15 nm gold nanocrystals). To cross-check the correctness of the literature models and the systems, we have reproduced a few versions of these optical systems in various configurations and studied the same batch of $Au@SiO_2$ NPs colloidal nanoparticles. As we discovered, the most commonly used model [1] cannot be straightforwardly implemented, because the results depend on experimental factors, such as setup geometry or the region of interest in the temperature probing. Moreover, numerous artefacts play a role such as accuracy of temperature determination, short and long term temperature drifts and many others.

In this talk, I will discuss current state-of-the-art, demonstrate existing setups and models, and based on our results, I will point out the most important issues that affect the light-to-heat conversion efficiency measurements [3].

[1] Microscale heat transfer transduced by surface plasmon resonant gold nanoparticles, D. K. Roper et al. , W. Ahn, and M. Hoepfner, J. Phys. Chem. C, vol. 111, no. 9, pp. 3636–3641, 2007.

[2] Experimental and theoretical studies of light-to-heat conversion and collective heating effects in metal nanoparticle solutions, H. H. Richardson, M. T. Carlson, P. J. Tandler, P. Hernandez, and A. O. Govorov, Nano Lett., vol. 9, no. 3, pp. 1139–1146, 2009.

[3] Standardization of light-to-heat conversion efficiency of colloidal nanoheaters, A. Paściak, A. Pilch-Wróbel, Ł. Marciniak, A. Bednarkiewicz (to be submitted)