Hybrid magnetic and luminescent nanostructures for self-monitored photothermal therapy

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Superparamagnetic iron oxide nanoparticles (SPIONs) are of interest as contrast agents for magnetic resonance imaging (MRI) and for therapeutic applications due to their potential heat dissipation in alternating magnetic fields. Recently it was also demonstrated that they can be employed for photothermal therapy (PTT) due to their strong light absorption and efficient transformation of IR-radiation into heat.[1]

In this work, we were interested in studying the photothermal properties of SPIONs by measuring the light-to-heat conversion, while thereby also creating multifunctional magnetic nanostructures (MNS) for temperature-controlled localized photothermal therapy. Furthermore, we wanted to achieve both PTT and luminescence-based nanothermometry in the biological windows; regions in the IR in which tissue penetration and subcutaneous applications of light are possible. Towards this goal we encapsulated SPIONs jointly with LaF_3:Nd nanoparticles, which act due to the presence of the Nd-dopant as sensitive nanothermometer, allowing full control and monitoring of the localized heat generation.

The MNS we will present, were synthesized by encapsulation in PLGA, a biocompatible polymer suited for in vivo applications. The resulting NS were chemically and spectroscopically characterized and their applicability for subcutaneous PTT was demonstrated in ex vivo experiments, while their magnetic properties remained. Hence, the MNS open a door for in vivo controlled photothermal therapy.

References

[1] Espinosa, A.; Di Corato, R.; Kolosnjaj-Tabi, J.; Flaud, P.; Pellegrino, T.; Wilhelm, C., *ACS Nano*, 10 (**2016**) 2436.