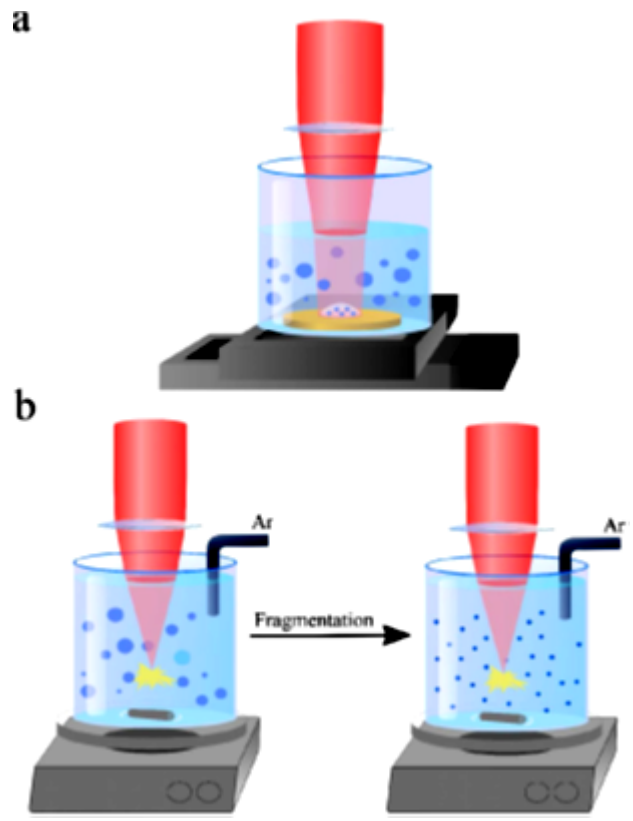
Laser- synthesized TiN nanoparticles as promising plasmonic alternative for biomedical applications

Exhibiting a red-shifted absorption/scattering feature compared to conventional plasmonic metals, titanium nitride nanoparticles (TiN NPs) look as very promising candidates for biomedical applications, but these applications are still underexplored despite the presence of extensive data for conventional plasmonic counterparts. Here, we report the fabrication of ultrapure, size-tunable TiN NPs by methods of femtosecond laser ablation in liquids and their biological testing. We show that TiN NPs demonstrate strong and broad plasmonic peak around 640–700 nm with a significant tail over 800 nm even for small NPs sizes (<7 nm). *In vitro* tests of laser-synthesized TiN NPs on cellular models evidence their low cytotoxicity and excellent cell uptake. We finally demonstrate a strong photothermal therapy effect on U87–MG cancer cell cultures using TiN NPs as sensitizers of local hyperthermia under near-infrared laser excitation. Based on absorption band in the region of relative tissue transparency and acceptable biocompatibility, laser-synthesized TiN NPs promise the advancement of biomedical modalities employing plasmonic effects, including absorption/scattering

contrast imaging, photothermal therapy, photoacoustic imaging and SERS.



(**a**) Schematics of laser ablation setup. A laser beam is focused on the surface of the TiN target, which is placed in the vessel filled with a liquid. The vessel is mounted on a moving translation stage to avoid ablation from the same area of the target. (**b**) Schematic of laser fragmentation setup to minimize size dispersion of NPs. Ar bubbling used optionally to remove dissolved oxygen.

For more information: https://www.nature.com/articles/s41598-018-37519-1