Faculty of Engineering
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Photophysical and Photochemical Studies at Nanoscales

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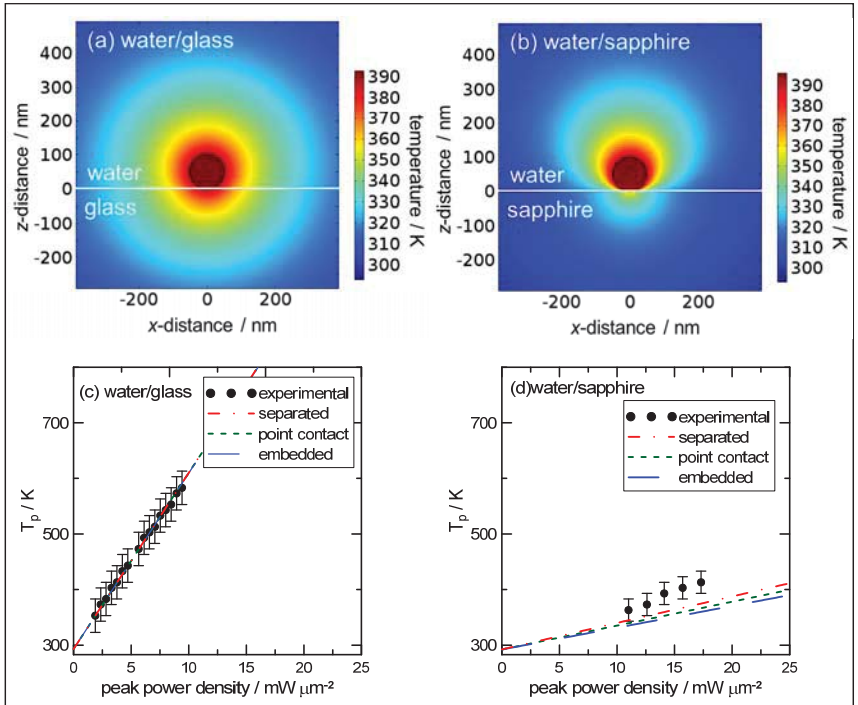

Fig. 1 CW Laser heating of a single 100-nm Au NP on a substrate in a medium

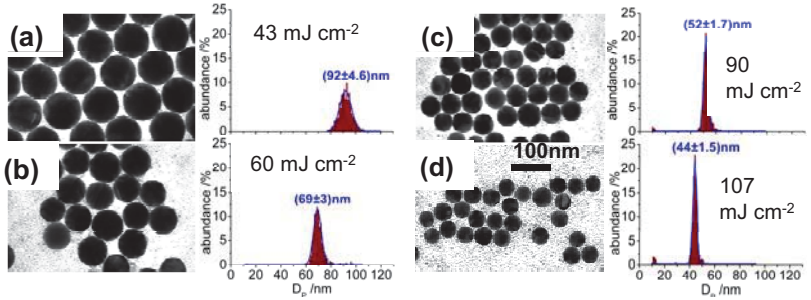

Fig. 2 Laser-induced size reduction of 100-nm Au NPs at 100 MPa

Scope:

Photophysical and photochemical studies at nanoscales have attracted considerable attention in the past decade inspired by potential application in biomedical fields and solar energy harvesting. We have been working on gold nanoparticles (Au NPs) and nanostrctures aiming at finding new phenomena characteristic of nanoscales.

Currently, our primary research interest is to construct a thermometer at nanoscales. We want to measure temperatures with a space resolution of 50-100 nm, which is below the diffraction limit of light. We used a single Au NPs of 100-nm diameter and heated the particle by laser illumination through a microscope objective. Fig. 1a and 1b display the 2D temperature profiles on glass and sapphire substrates in water. The temperature distribution is remarkably dependent on the substrate. The experimental laser intensity-dependent temperature is in good agreement with a simulation and reliable temperature estimation is feasible (**ACS Nano, 2013, 7, 7874**.).

We have also been interested in laser-induced morphological changes of aqueous colloidal Au NPs. We used external high pressures of 60-400 MPa for the morphological control. Fig. 2 shows the laser intensity-dependent size changes of initial 100-nm Au NPs at 100 MPa. Five nanosecond (FWHM) laser pulses with a wavelength of 532 nm was employed for excition. The result indicated that the extent of the size reduction is remarkably dependent on the laser fluence and the size control is possible via the laser intensity (**Langmuir, 2013, 29, 1295**.).

Keywords : gold nanoparticles, lasers, optical microscopy

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