Extreme Photonics Seminar

No. 6

Language: English

Date : Mar.12(Wed), 2014, 16:00 ~ 17:00

Location : Cooperation Center, 5F Meeting Room, W524
(研究交流棟5階会議室W524)

Title : Femtosecond laser nanoablation of biomaterials by enhanced optical field

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Laser nanoprocessing of biomaterials by focused optical field and far field excited by femtosecond laser will be presented. A focused optical field generated around a nanostructure can concentrate optical energy into a nanoscale space, enabling precise processing in sub-micro to nanoscale area. By using this technique, both “material in the vicinity of nano-structure” and “nano-structure itself” can be a target of laser ablation. As for the former case, the focused optical field under biodegradable polymer microspheres, which were conjugated to cells, provides simultaneous cell membrane perforation of multiple cells by a single shot of 800 nm femtosecond laser illumination. Owing to a little linear optical absorption and relatively low scattering coefficients at near-infrared wavelength, the interaction zone is localized in a focused spot on the cell membrane by nonlinear interaction, resulting in a little damage to the cell. As for the latter case, an enhanced optical field generated on a shell of hollow microcapsules realizes localized disruption of the shell. This method is a promising approach for drug delivery by controlling the release of drug molecules embedded in the microcapsule. Optical far field excited by femtosecond laser is also useful for nanoablation. Interference of scattered far field and indent wave provides the formation of ripple structure on a material surface. We demonstrated ripple structure formation on a biodegradable polymer surface by using femtosecond laser pulses. The origin of such structures is still under discussion, but it is highly probable that scatterers, such as surface roughness and defects, contribute to the formation of ripple structure.

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