Laser technologies: From physics of ablation to surface nanostructuring and to synthesis of colloids

Inogamov N A[1,2], Zhakhovsky V V[2], Khokhlov V A[1,@] and Petrov Yu V[1,3]

[1] Landau Institute for Theoretical Physics of the Russian Academy of Sciences, Akademika Semenova 1a, Chernogolovka, Moscow Region 142432, Russia
[2] Dukhov Research Institute of Automatics (VNIIA), Sushchevskaya 22, Moscow 127055, Russia
[3] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region 141701, Russia

[@] nailinogamov@gmail.com

Laser technologies cover a broad range of modern industrial applications, from the automotive industry, shipbuilding and mechanical engineering to the printing of meta-surfaces for microelectronics, plasmonics, sensors, etc. In many cases these applications run ahead a physical theory which should support planning and optimization of production. Authors report here recently obtained results. They reveal hierarchies of physical processes taking place during synthesis of colloidal solutions of nanoparticles via ablation of metals in liquid and nanostructuring of metasurfaces. Evolution from early to late stages of ablation in liquid is followed. Influence of duration of a pulse is described. Dissolution–evaporation of metal atoms through a surface barrier into liquid and removal of this barrier at higher temperatures above critical temperature (surface tension decreases to zero) and transfer from dissolution and diffusion to pure diffusion are considered. Condensation of dissolved metal atoms inside dense environment (thus outside existing theories of nucleation) is studied.