

Non-thermal regimes of laser annealing of semiconductor nanostructures

Inam Mirza¹, Alexander V. Bulgakov¹, Hanna Sopha^{2,3}, Hana Turčičová¹, Ondřej Novák¹, Jiří Mužík¹, Martin Smrž¹, Tomáš Mocek¹, Jan M. Macak^{2,3} and Nadezhda M. Bulgakova¹

¹HiLASE Centre, Institute of Physics of the Czech Academy of Sciences, Dolní Břežany, Czechia

²Center of Materials and Nanotechnologies, Faculty of Chemical Technology, University of Pardubice, Pardubice, Czechia

³Central European Institute of Technology, Brno University of Technology, Brno, Czechia

Corresponding author email: mirza@fzu.cz

Although amorphous semiconductor nanomaterials (SNMs) are widely used in various fields of science and technology [1, 2], their crystalline forms often exhibit physical and chemical properties much more suitable for many applications [3, 4]. Specifically, highly ordered layers of anodic TiO₂ nanotubes of crystalline anatase form attract considerable attention in the fields of solar energy harvesting, photocatalysis, and sensing [5]. Thus, there is need for techniques which enable reliable and reproducible crystallization of amorphous semiconductor nanomaterials, often locally and selectively, to fabricate high-quality products.

In this talk, we will present the results of laser-induced crystallization of TiO₂ nanotube layers using high-power UV (258 nm) ~1 ps pulsed laser built at HiLASE Center. To understand the mechanisms of the achieved laser-induced transformations, we involve concepts of non-equilibrium ultrafast processes such as explosive crystallization induced by laser-generated stress waves and ultrafast laser melting [6]. The requirements for the laser parameters to induce crystallization without damaging material morphology will also be discussed.

References:

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