PICOSECOND PULSED LASER ABLATION OF SILICON SINGLE CRYSTAL

D. M. POPOVIC[1], A. KUSHIMA[2], A. A. ZEKIC[1], B. KASALICA[1], J. STASIC[3], J. CIGANOVIC[3], M. BOGDANOVIC[1] and M. TRTICA[3]

[1]*University of Belgrade, Faculty of Physics, Studentski trg 12, 11001 Belgrade, Serbia*
E-mail dusan@ff.bg.ac.rs

[2]*Advanced Materials Processing and Analysis Center, Department of Materials Science and Engineering, University of Central Florida, Orlando, Florida 32816, USA*

[3]*Vinca Institute of Nuclear Science, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*

Abstract. Silicon-based nanoparticles (SiNPs) attract authors' attention due its application prospects in a mutual field, from energy storage to bio-imaging. One of the most prominent methods for synthesis of SiNPs is pulsed laser ablation in liquid media (LAL), because it is simple, and it provides the minimum of contamination of the sample produced. Employed pulsed lasers in LAL are ns- and ps-, and the usage of fs- lasers are reported recently, as well. The objects of the LAL analyses are ablated craters on the Si target surface and, predominantly, the ablated material.

Here, SiNPs are synthesized by ps- laser (150 ps, 1064 nm) ablation of Si single-crystal plates in de-ionized water. The focus of the work is the impact of the additional continuous wave (CW) laser (532nm) on the properties of the ablated material, i.e. SiNPs produced. The comprehensive analyses were performed, including the SiNPs' size distribution, agglomeration abilities, aging, chemical properties (amount of oxygen and its distribution within the particles), and photoluminescence (PL) properties of the solution produced. It is demonstrated that PL properties of obtained SiNPs solution are impacted by introducing the CW laser in the ablation process. The peculiarity lies in the fact that such impact depends on both the PL excitation wavelength and the power of the introduced CW laser, which might open the possibility of successful tailoring of SiNPs produced by LAL.

References

Petersen, S., Barcikowski, S. 2009, Adv. Funct. Mater. 19(8), 1167.

Intartaglia, R., Bagga, K., Brandi, F., 2014, Opt. Express 22(3), 3117.

Vaccaro, L., Sciortino, L., Messina, F., Buscarino, G., Agnello, S., Cannas, M., 2014, Appl. Surf. Sci. 302, 62.

Caltagirone, C., Bettoschi, A,. Garau, A., Montis, R., 2015, Chem. Soc. Rev. 44(14), 4645.

Popovic, D. M., Kushima, A., Bogdanovic, M. I., Chai, J. S., Kasalica, B., Trtica, M., Stasic, J., Zekic, A. A., 2017, Journal of Applied Physics, 122(11), 113107.