

COMPARATIVE STUDY OF NUMERICAL MODELS OF IONIZATION DYNAMICS IN LASER-INDUCED BREAKDOWN OF SOLIDS AND GASES

Jasna Stevanović¹, Violeta Petrović¹, Hristina Delibašić-Marković¹, Ivan Petrović²

¹University of Kragujevac, Faculty of Science, Radoja Domanovića 12, 34000 Kragujevac, Serbia, jasna.stevanovic@pmf.kg.ac.rs, violeta.petrovickg@gmail.com, hristina.delibasic@pmf.kg.ac.rs

²Academy of Professional Studies Šumadija, Department in Kragujevac, Kosovska 8, 34000 Kragujevac, Serbia, kgivanpetrovic@gmail.com

ABSTRACT

Laser-induced breakdown in solids and gases involves complex ionization dynamics that occur on ultrafast time scales. In this work, we present a comparative review of the specific features of laser-induced breakdown (LIB) in gases and solid materials. We also present appropriate numerical approaches that allow the calculation of ionization event rates at given moments in time and for specific laser intensities (high-intensity Nd:YAG laser pulses within the 200–1064 nm wavelength range), enabling the study of the temporal evolution of a key parameter—free electron density. The influence of different parameters, such as wavelength, as well as various underlying physical phenomena, is considered. This approach makes it possible to analyze how different parameters affect laser-induced breakdown and to use that insight to predict and fine-tune laser settings for specific applications.

Keywords: numerical simulations, laser-induced breakdown, free-electron density.

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