Description of the dynamics of vibrationally excited states of hydrogen in a model of the gas atmosphere near a plasma radiation source

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Nowadays photolithography is a key technology for integrated circuit manufacturing. Advanced research shows efficiency of using EUV-radiation (extreme ultraviolet radiation) in chip printing [1–3]. The chamber of an industrial radiation source is usually filled with a buffer shielding gas. Usually hydrogen is used for protecting optics of the plasma radiation source. Hydrogen in the chamber is ionized by EUV-radiation. Fast electrons and ions are formed during photoionization, which lead to the formation of vibrationally excited states of hydrogen. The processes of vibrational relaxation of hydrogen influence the redistribution of energy in the system. Thus, the study of the dynamics of vibrationally excited states of hydrogen is problem of current interest to the semiconductor industry.
In this paper, the role of excitation of vibrationally excited hydrogen states in a model of the gas atmosphere near a plasma radiation source is investigated. The optimal value of the considered vibrational levels in the model is established. The paper shows consideration of influence of oscillations on the temperature inside the source chamber. The results are obtained using a three-dimensional code describing the interaction of plasma and gas in the chamber of an EUV-source.

[1] Abramenko D B 2019 *Phys.-Usp.* **62** 304–314
[2] Fomenkov I 2017 *Adv. Opt. Technol.*
[3] Banine V Y, Koshelev K N and Swinkels G H P M *J. Phys. D: Appl. Phys.* **44**