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Second harmonic wave generation in ununiform microwave plasma by metamaterial effect AKINORI IWAI, YOSHIHIRO NAKAMURA, Kyoto University, OSAMU SAKAI, The University of Shiga Prefecture, THE UNIVERSITY OF SHIGA PREFECTURE TEAM, KYOTO UNIVERSITY TEAM —
We performed the monitoring of plasma parameters and intensity of second harmonic (SH) wave in the composite of microwave overdense plasma and the metamaterial under the various conditions; input power, gas pressure and the position of the detection. Plasma has been dealt with the nonlinear optical material because of the inherent nonlinearity based on the complex motion of particles in plasma. Moreover, generation of ions from plasma is important for many industrial processes. However, electron density n_{e} provides the threshold frequency ω_{pe} and the electromagnetic (EM) wave cannot penetrate into rich-n_{e} plasma when the frequency is under ω_{pe}; plasma permittivity (ε) becomes negative. We introduced double-splitring resonators (DSRRs), one of metamaterials, which macroscopically have negative permeability (μ) by the magnetic resonance, and canceled the negative ε. Our previous report [1] included the rough results about SH wave generation and n_{e} in terms of the monitoring positions. In this report, we show the relation between the propagation of the input wave (2.45 GHz), SH wave and parameters of generated plasma in detail, and clarify the microscopic effect of DSRRs [1] A. Iwai, Y. Nakamura, and O. Sakai, Phys. Rev. E, 92 (2015) 033105.

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