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Second harmonic wave generation from a nonlinear combination of volume wave and overdense plasma in negative permeability space AKINORI IWAI, YOSHIHIRO NAKAMURA, Kyoto University, OSAMU SAKAI, The University of Shiga Prefecture — We clarify the relation between second harmonic wave (SH wave) and plasma generation in various experimental conditions by detecting properties of propagating electromagnetic waves (EM waves). Plasma has a nonlinear reaction against EM wave, generating harmonic waves which depends on electron density n_e. In the case with increased n_e, EM wave comes to be prevented from going into plasma with negative permittivity ε_p. Double-split-ring resonators (DSRRs), one of metamaterials, make permeability μ_D negative. We have shown that EM wave being volume wave can propagate into the combination of overdense plasma and DSRRs because of real negative value refractive index N. In our previous paper [1], we have confirmed enhanced SH wave (4.9 GHz) generation in the composite with 2.45-GHz input. In this report, we show the dependence of the SH wave emission with plasma generation on plasma parameters and gas conditions of plasma. Furthermore, we show the phase change with N variation of the composite space in the case with various input power as the proof of the negative index state. [1] A. Iwai, Y. Nakamura, and O. Sakai, Phys. Rev. E, 92 (2015) 033105.

Akinori Iwai
Kyoto University

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