

Abstract Submitted
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Microwave plasma source based on plasma-metamaterial nonlinearity. OSAMU SAKAI, AKINORI IWAI, SHIGEYUKI MIYAGI, The University of Shiga Prefecture — Microwave plasmas are one of the main plasma sources applicable for various industrial material processes. Changing magnetic permeability based on metamaterial concepts [1], we verified expansion of plasma parameters as well as nonuniform profiles of microscopic parameters inside a plasma [2]. In this study, focusing on nonlinearity inherent in a plasma-metamaterial composite [3], we investigate microwave signals detected in microwave plasma with various reactor designs. When we set negative-permeability metamaterial in microwave plasma space, we detected enhancement and saturation of microwave signals as the input power was raised and nonlinear properties emerged. However, in the case without this metamaterial, the detected signals decreased in the opposite tendency. These results suggest that prediction from linear wave propagation is partially valid in both cases, but a nonlinear property emerging in high-power microwave plasma with metamaterial effects may include more rich behaviors that have not been observed so far. [1] A. Iwai, F. Righetti, B. Wang, O. Sakai and M. A. Cappelli, *Phys. Plasmas* 27, 023511 (2020). [2] A. Iwai, Y. Nakamura, O. Sakai and Y. Omura, *Plasma Sources Sci. Technol.* 29, 035012 (2020). [3] O. Sakai, *J. App. Phys.* 109, 084914 (2011).

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