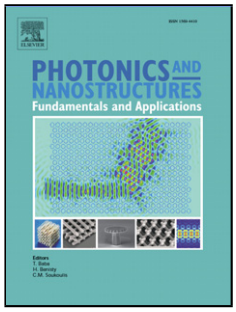

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Author: N. Yogesh Quanqiang Yu Zhengbiao Ouyang

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Single- and Multi-Beam Confinement of Electromagnetic Waves in a Photonic Crystal Open Cavity Providing Rapid Heating and High Temperatures

N. Yogesh, Quanqiang Yu, and Zhengbiao Ouyang*

Solid State Photonics Laboratory, THz Technical Research Center, Shenzhen Key Laboratory of Micro-nano Photonic Information Technology, Key Laboratory of Optoelectronic Device and Systems of Ministry of Education and Guangdong Province, College of Electronic Science and Technology, Shenzhen University, Shenzhen 518060, China

**Corresponding author: zbouyang@szu.edu.cn*

Abstract: Light is the best energy source for heating substances. As an attempt to utilize light energy, we demonstrate the single- and multi-beam confinement of electromagnetic (EM) waves in an open cavity formed by one-dimensional photonic crystals for efficient heat conversion. The multilayer cavity confines electromagnetic waves at near band-edge frequencies uniquely. We use this confinement to heat substances under normal and oblique incident radiations. We perform electromagnetic thermal co-simulation to demonstrate the functionality of rapid heating under single- and multi-beam excitations of EM waves. The cavity shows a rapid heating rate of 4°C/sec for a nominal input power of 850 W under single-beam excitation. The demonstration of multi-beam (four beams) confinement in the proposed cavity reveals ultra-high temperatures at the rate of 560°C/sec for the input electric field strength of 1000 V/m. The role of strong perturbation in heat conversion task is studied with respect to various substances. Finally, we have demonstrated the heating effect under oblique incidence of weak EM radiations so that the proposed cavity can avail the utilization of natural radiation for better green life. The proposed multilayer cavity is anticipated for laser heating, creation of plasmas and renewable energy sources.