

21COE Programme: Mechanical Systems Innovation Open Seminar

21COE Programme: Mechanical System Innovation Forth Open Seminar 2005 will be held as follows. Any participants will be welcome. People from Materials, Electrical engineering and Physics fields may also be interested in the topic.

Invited Speaker: Associate Professor Zhuomin Zhang, Ph.D. (George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology)

Title: Coherent Thermal Emission in Modified One-Dimensional Photonic Crystals

Date & Time: 8th July 2005 (Friday), 16:00~17:30

Place: The University of Tokyo, Engineering Building No.2, 2nd Floor,
Lecture Room No.28

Abstract: Spectral and directional control of thermal emission is important for applications in optoelectronics and energy conversion. A number of structures have been proposed as coherent emission sources, which create spectral emission peaks in well-defined directions. The grating structure was commonly used, and coherent emission in gratings was achieved by excitation of surface polaritons or surface waves. The present study demonstrates that coherent emission can be realized based on a multilayer structure, consisting of a semi-infinite one-dimensional photonic crystal coated with a polar material (such as SiC). We have identified three modes that can enhance the thermal emission in a narrow mid-infrared wavelength band. (1) By excitation of surface waves at the interface between SiC and the photonic crystal, coherent emission can be achieved for both the s polarization (TE wave) and p polarization (TM wave). The resulting emission peak is confined in a narrow angular range (high directional). (2) Thermal emission from the proposed structure can also be significantly enhanced by the cavity resonance mode, similar to that of a Fabry-Perot etalon. The resulting coherent emission peaks have a broad angular distribution (different-type emitter). (3) For p polarization, the Brewster mode (at which the reflectivity between air and SiC is minimal) can also induce large emissivity peaks in the stop band of the photonic crystal. The proposed planar structure involves dielectric films only without gratings and can be used to realize coherent emission for either polarization.

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