CIRMM

Nomura LAB.

［Physics and device applications of Integrated quantum electronic systems］

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Integrated Quantum Electronics

Department of Electronic Engineering and Information Systems

Thermal conduction nanoengineering and application to thermoelectronics

Coherent control of heat transfer in semiconductor nanostructures by phononics

Thermal conduction, which is normally unique to a particular material, can be controlled by nanoengineering. Our goal is to use nanofabrication technology to develop highly efficient silicon thermoelectric devices for energy autonomous devices and thermoelectric applications.

- Thermal conduction control by phononics ~Si phononic crystal nanostructures~
- Heat transport in semiconductor nanostructures and thermoelectric applications
- Physics in optomechanical systems with photonic crystal nanocavity

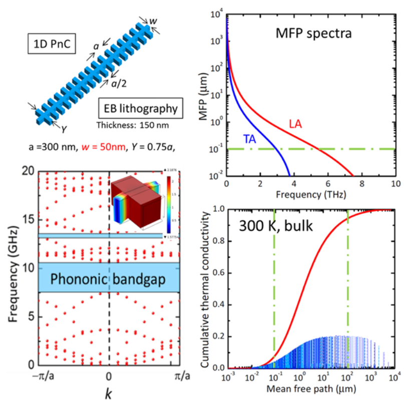

Fig. 1. One dimensional PnC and its band diagram. LA and TA phonon mean free path in bulk Si and cumulative thermal conductance.

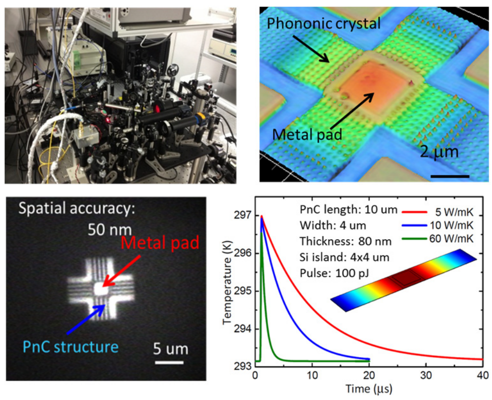

Fig. 2. Time-domain thermoreflectance system. Simulated heat dissipation in a 2D PnC structure.

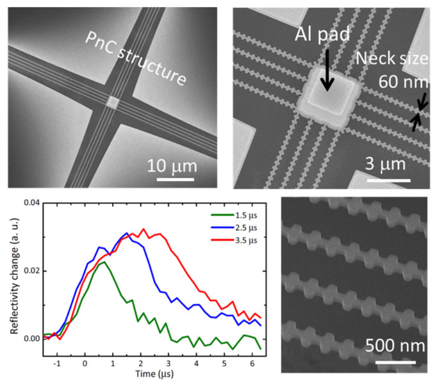

Fig. 3. SEM of 1D PnC structures and heat dissipation from a microstructure measured by time-domain thermoreflectance method.

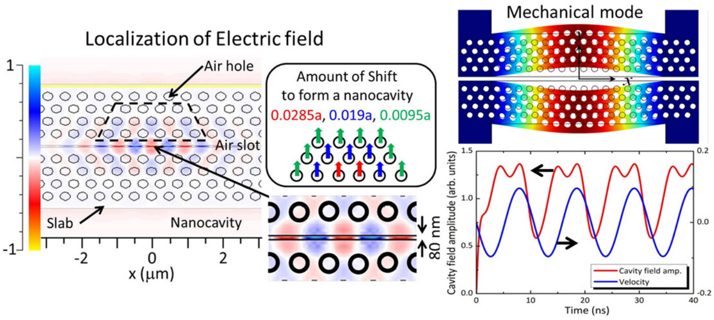

Fig. 4. Electric field localization in photonic crystal nanocavity and the fundamental vibration mode o the nanomechanical oscillator.

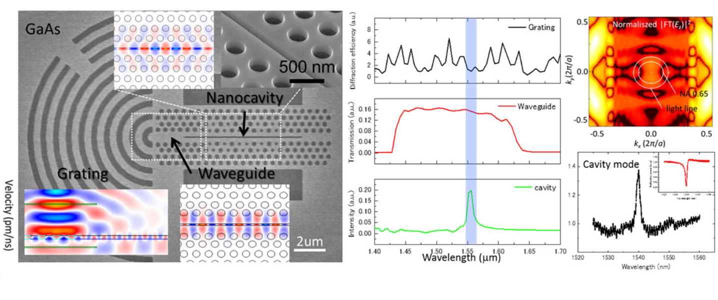

Fig. 5. Investigated GaAs optomechanical system with an air-slot PhC nanocavity and its optical properties.

Partially collaboration with Hirakawa Lab. and Arakawa-Iwamoto Labs.