COUPLING OF NEAR-FIELD THERMAL RADIATIVE HEATING AND PHONON MONTE CARLO SIMULATION: ASSESSMMENT OF TEMPERATURE GRADIENT IN N-DOPED SILICON THIN FILM

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ABSTRACT. Near-field thermal radiative exchange between two objects is typically more effective than the far-field thermal radiative exchange as the heat flux can increase up to several orders higher in magnitudes due to tunneling of evanescent waves. Such an interesting phenomenon has started to gain its popularity in nanotechnology, especially in nano-gap thermophotovoltaic systems and near-field radiative cooling of micro-/nano-devices. Here, we explored the existence of thermal gradient within an *n*-doped silicon thin film when it is subjected to intensive near-field thermal radiative heating. The near-field radiative power density deposited within the film is calculated using the Maxwell equations combined with fluctuational electrodynamics. A phonon Monte Carlo simulation is then used to assess the temperature gradient by treating the near-field radiative power density as the heat source. Results indicated that it is improbable to have temperature gradient with the near-field radiative heating as a continuous source unless the source comprises of ultra-short radiative pulses with a strong power density.