

EXPERIMENTAL STUDY OF NEAR-FIELD HEAT TRANSFER BETWEEN TWO SiO₂ FILMS ON SILICON SUBSTRATE

Song Li¹, Deyu Xu¹, Junming Zhao^{1,3,*}, Linhua Liu²

¹ School of Energy Science and Engineering, Harbin Institute of Technology, Harbin 150001, China

² School of Energy and Power Engineering, Shandong University, Qingdao 266237, China

³ Key Laboratory of Aerospace Thermophysics, Ministry of Industry and Information Technology, China

ABSTRACT. In near-field radiative heat transfer experiments, the experimental scheme using nano-spacers to fix the distance between two plates can be applied in near-field thermophotovoltaic and thermal regulation devices. In this work, near-field radiative heat flux between two SiO₂ films on a silicon substrate was experimentally investigated. The two samples are supported by SiO₂ nano-spacers with 306 nm height. The near-field radiative heat flux between 5 mm × 5 mm SiO₂ films is measured at 10 ~ 42 K temperature difference. The measurement results show that the measured near-field radiative heat flux agrees well with the theoretical near-field radiative heat flux at a distance of 223 ± 25 nm, which demonstrates the compression of the nano-spacers, caused by the mass of the setup above the receiver, affects the distance between the two plates, which in turn affects the near-field radiative heat flux. The measured near-field radiative heat flux can be enhanced to 14.52 times compared with the black body radiative heat flux. This paper can guide subsequent near-field experiments and near-field device analysis.

* Corresponding Author: jmzhao@hit.edu.cn (Junming Zhao).