Near-field radiative heat transfer at the nanoscale

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Radiative heat transfer between objects at different temperatures is of fundamental importance in applications such as energy conversion, thermal management, lithography, data storage, and thermal microscopy [1,2]. It was predicted long ago that when the separation between objects is smaller than the thermal wavelength, which is of the order of 10 μm at room temperature, the radiative heat transfer can be greatly enhanced due to the contribution of evanescent waves (or photon tunneling) [3]. In recent years, different experimental studies have confirmed this long-standing theoretical prediction. However, in spite of this progress, there are still many basic open questions in the context of near-field radiative heat transfer. In this talk, I will review our recent theoretical and experiment efforts to shed new light on this fundamental problem. In particular, I will discuss the following two basic issues: (i) the enhanced near-field radiative heat transfer using polar dielectric thin films [4] and (ii) the radiative heat transfer in the extreme near-field regime when objects are separated by nanometer-size distances [5].

References

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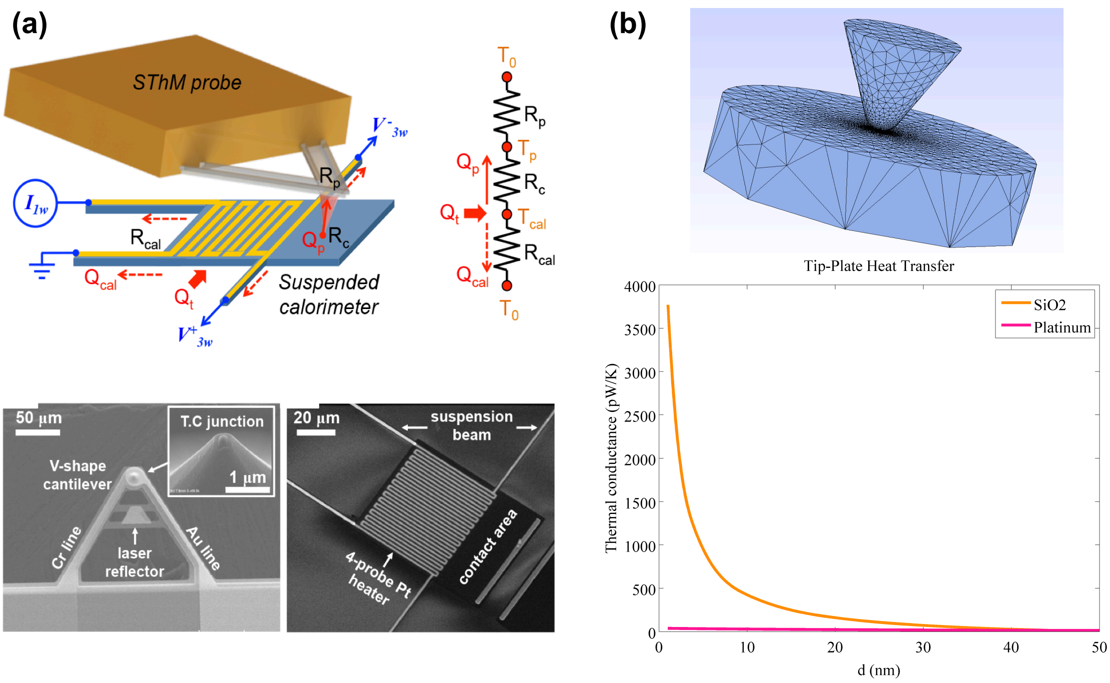
Figure



(a) Schematic diagram of a scanning thermal microscopy probe. (**b**) Numerical simulation of the radiative thermal conductance between an AFM tip and a flat substrate made of both SiO_2 and platinum.