Fiber Coupled Near-Field Thermoplasmonic Emission from Gold Nanorods at 1100 K

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Nanostructured gold has attracted significant interest from materials science, chemistry, optics and photonics, and biology due to their extraordinary potential for manipulating visible and near-infrared light through the excitation of plasmon resonances. However, gold nanostructures are rarely measured experimentally in their plasmonic properties and hardly used for high-temperature applications because of the inherent instability in mass and shape due to the high surface energy at elevated temperatures. In this work, we demonstrate the first direct observation of thermally excited surface plasmons in gold nanorods at 1100 K. By coupling with an optical fiber in the near-field, the thermally excited surface plasmons from gold nanorods can be converted into the propagating modes in the optical fiber and experimentally characterized in a remote manner. We also develop a direct simulation scheme to quantitively understand the thermal emission from the array of gold nanorods. Our experimental work in conjunction with the direct simulation results paves the way of using gold nanostructures as high-temperature plasmonic nanomaterials, which has important implications in thermal energy conversion, thermal emission control and chemical sensing.