一种新型**MEMS**器件中的近场辐射传热现象研究

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摘　要：

以近场辐射传热方式利用光电器件中的热能制作热光电器件从而提高整个器件转换效率的思想已经被提出。本文基于该思想设计一种新型的具有双悬空薄膜的器件，两个薄膜面对面相互平行，间距为1 m m。每个悬空薄膜中制作白金薄膜电阻。这个器件利用MEMS工艺中的牺牲层技术制作。在存在近场辐射传热和不存在近场辐射传热两种情况下，通过测量将下方结构加热到相同温度的输入功率差，测量出两个薄膜间的辐射热功率。实验数据表明该器件中薄膜间的传热已经大于黑体辐射传热；并且，当上方薄膜温度为317.2 K时，通过近场辐射传热可以使下方薄膜的温度从293 K升高294.2 K，该温度变化为热电转换提供了条件。

关键词：MEMS；器件；近场辐射；传热；

The near-field radiative heat transfer studying of a Novel MEMS device

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Abstract:

An idea of improving the efficiency of photovoltaic device has been proposed by using the near-field thermal radiation to implement a thermophotovoltaic device. Base on this idea a novel device that has two freestanding membranes was designed in this work. The two membranes parallel to each other in plane-plane geometry and the distance between them is 1 micrometer. Each membrane had a Pt (platinum) thin-film resistor. The device was fabricated by a sacrificial layer technique in the MEMS (micro electromechanical system) technology. The heating power difference between with and without the near-field heat transfer was experimentally measured while heating the emitter to the same temperature. The near-field radiative heat transfer between the two membranes was evaluated based on the heating power difference, which was larger than that of black body radiation under the same temperature condition. And when the upper membrane worked as a hot emitter and its temperature was 317.2 K, the lower membrane temperature would increase from 293 K to 294.2 K by the near-field thermal radiation between them, which makes thermoelectric conversion possible.

Keywords: MEMS; Device; Near-field radiation; heat transfer

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