# Development of the Photothermal-Resistance Technique to Characterize the Thermophysical Properties of One-Dimensional Micro/Nanoscale Structures

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In this work, a new technique, the photothermal-resistance technique, is developed to characterize the thermophysical properties of one-dimensional micro/nanostructures. In this technique, the to-be-measured thin wire/tube is suspended over two electrodes and is irradiated with a periodically modulated laser beam. The laser beam induces a periodical temperature variation in the wire/tube, which will result in a periodical change of its electrical resistance. A DC current is applied to the sample, and the resulting periodical voltage variation over the wire is measured and used to extract the thermophysical properties of the wire/tube. A 25.4 μm thick platinum wire is used as the reference sample to verify this new technique. Sound agreement is obtained between the measured thermal conductivity and the reference value. Applying the photothermal-resistance technique, the thermal diffusivity of single-wall carbon nanotube bundles is measured. The thermal diffusivity measured for three different single-wall carbon nanotube bundles is $2.98 \times 10^{-5}$ $m^2/s$, $4.41 \times 10^{-5}$ $m^2/s$, and $6.64 \times 10^{-5}$ $m^2/s$, respectively. These values are much less than the thermal diffusivity of graphite.