Development of Innovative Nano-Micro Level Thermophysical Properties Sensing Techniques and Their Applications

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【Outline of survey】

The sensing techniques of nano and micro-level thermophysical properties are very important in broad cross-disciplinary fields on the basis of research and development of leading-edge technology. For example, in nanotechnology fields we need to evaluate thermal conductivity of newly developed nano-materials such as SWNT in order to design various devices utilizing these materials. In biotechnology fields it is important to control the diffusion and separation of DNA and proteins. In spite of these intense demands, we are often faced with the problems that the widely used conventional techniques to measure thermophysical properties are entirely unsuitable for such materials and conditions owing to their limitation of spatial and temporal resolutions.

The aim of the present study is to develop innovative optical sensing techniques to measure wide variety of thermophysical properties (thermal conductivity, thermal diffusivity, mass diffusion coefficient, thermal diffusion factor, viscosity, surface tension and surface viscoelastisity) with (1) non-invasive and in situ, (2) high spatial resolution, (3) high temporal resolution, (4) small amount of sample and (5) 2D distribution measurement applicable to anisotropic materials.

【Expected results】

The sensing techniques in the present study can be applicable to nano and micro-level systems because they utilize physical phenomena such as near-field light, interference of temperature wave, Soret effect, laser-induced capillary wave and thermally driven capillary wave which posses inherently high spatial resolution. It can be expected that the development of these sensing techniques can contribute to quantitative evaluation of transport phenomena in nono and micro-level in wide variety of systems.

【References by the principal investigator】

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・" Development of Laser-Induced Capillary Wave Method for Viscosity Measurement Using Pulsed Carbon Dioxide Laser", Nagasaka, Y. et al., Int. J. Thermophys., 25(5), 1461-1474 (2004).

【Term of project】 FY2007－2011	【Budget allocation】 29,600,000 yen (2007 direct cost)

【Homepage address】 http://www.naga.sd.keio.ac.jp/kiban-s.html/