Technique for reliable thermal diffusivity measurement

Approach for inherent thermal diffusivity of solid materials

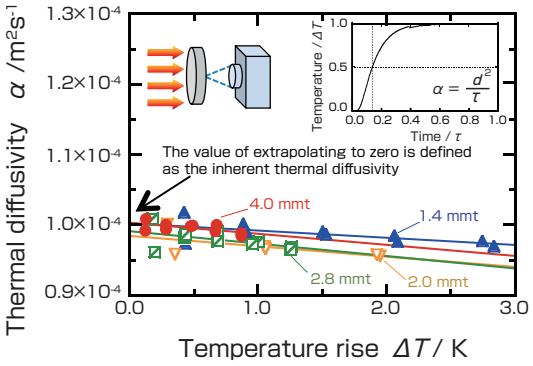
We established the SI traceable and inherent thermal diffusivity measurement. The thermal diffusivity is a thermophysical property dependent on temperature and it is obtained as a function of specimen thickness and heat diffusion time determined by the laser flash method. The measurement system in AIST became traceable to length, time and temperature. Thermal diffusivity should not be independent of measurement conditions since it is unique for the material. However, thermal diffusivity measured by the laser flash method sometimes depends on the conditions. To solve this problem, we developed a procedure for the laser flash method. Apparent thermal diffusivity values are first measured by changing pulse heating energy at the same temperature. Then the inherent thermal diffusivity is determined by extrapolating these apparent values at the zero energy pulse heating. It was confirmed that the inherent thermal diffusivity obtained by the procedure is independent of measurement conditions. We verified the effect of the procedure from an international joint research between AIST and Laboratoire national de métrologie et d'essais.

Megumi AKOSHIMA

Metrology Institute of Japan

m-akoshima@aist.go.jp

AIST TODAY Vol.12 No.1 p.19 (2012)



An example of inherent thermal diffusivity determination of isotropic graphite changing pulsed heating energy at room temperature

A certified reference material for thermal diffusivity measurement

For quantitative measurements of high and ultrahigh vacuum

Development of standard conductance element

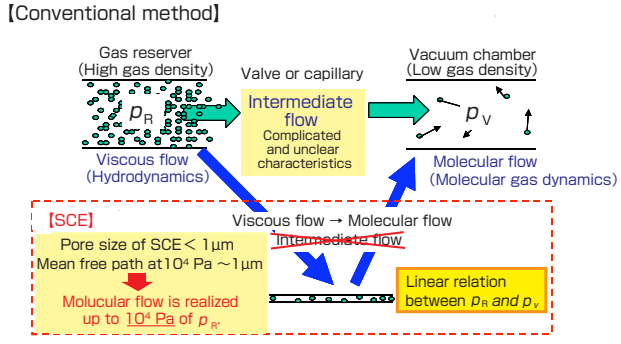
A new element, named "standard conductance element (SCE)" , has been developed for in situ calibration of ionization gauges and quadrupole mass spectrometers. The SCE is a stainless-steel sintered filter with a pore size of less than 1 μm. Since the gas flow through the SCE satisfies the molecular flow condition even at the pressure up to 10^4 Pa, several useful characteristics of molecular flow are available: (1) calibration for various gas species only with this single leak element, (2) easy multi-point calibration, (3) calibration for mixture gases, (4) small and theoretical temperature dependence of flow rate. These advantages were experimentally demonstrated. The SCE is supplied to users with a calibration certificate describing its molecular conductance. Users can introduce arbitrary test gases with the known flow rate to their vacuum chamber through the SCE in their laboratories.

Hajime YOSHIDA

National Metrology Institute of Japan

hajime-yoshida@aist.go.jp

AIST TODAY Vol.12 No.2 p.17 (2012)



Principle of standard conductance element (SCE)

Photograph of standard conductance element (SCE)