

Specific Heat Capacity Measurements of a Solid Using Differential Scanning Calorimetry - Measurement Accuracy for Metal, Metal-Oxide and Plastic Disk Specimens -

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Differential scanning calorimetry is well known as a simplified measuring method of thermal properties. It can be used for the measurement of specific heat capacity of solid. However, the recommended shape and amount of solid specimen, the recommended heating rate and the choice of appropriate standard reference material for reliable measurements are still not fully specified. On the other hand, samples vary in type, like thermal insulating, high thermal conducting, pure, homogeneous and composite materials. Furthermore, there are platy, fibrous, granulated or powdered specimens. It is not easy to specify the conditions for reliable measurements. This paper discusses the reliability of the specific heat capacity measurements of a solid using a heat-flux differential scanning calorimeter and synthetic sapphire disks 99.99 % in purity as standard reference material. In this work, three metal disks (copper 99.96 % in purity, molybdenum 99.95 %, silver 99.99 %), metal-oxide disk (rutile 99.99 % in purity) and two plastic disks (acrylic resin and polyethylene) are used for test substances. The heated surface of these disk specimens is polished, and the surface roughness is below 0.6 μm . For the metal and metal-oxide specimens, the variation in the DSC output and specific heat capacity data decreases with increasing the mass of specimen. The variation in the DSC output is independent of the heating rates and temperature. Although the specific heat capacity data differ according to the heating rates ranging from 2 to 15 K/min, the effect of the heating rate is within 3 %. The specific heat capacity data agrees with the reference data (Y.S. Touloukian et al., *The TPRC Data Series*, 1970) within ± 3 %. In addition, uncertainties are estimated to be within ± 5 % at temperatures from room temperature to 388 K.

In contrast, the specific heat capacity data for the plastic specimens decreases with increasing the mass and heating rate. The results obtained for polyethylene disks are much lower than the reference data (JSTP, *Thermophysical Properties Handbook*, 1990).