DSC Heat Flow Measurement Technique

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A new technology for measuring heat flow in DSC has been developed that has significant advantages over existing heat flow measurements. Sample heat flow is calculated from the DSC signals using an equation with four terms that accounts for heat flow within the sensor in addition to the sample and reference heat flow. By including the effects of heat flow within the sensor, dynamic response of the heat flow measurement is enhanced improving resolution. The heat flow baseline is improved by accounting for slight imbalances between the sample and reference sides of the instrument. The result is a truer measurement of sample heat flow than conventional DSC. A new DSC heat flux sensor has been developed to take advantage of the new measurement technique. The sensor has thermally independent sample and reference positions and includes two differential temperature measurements that are required to use the four-term heat flow equation. Extension of the measurement technique to include the heat exchange effects of the sample and reference pans yields an additional increase in resolution and improves accuracy of the sample heat flow measurement. A new temperature modulated DSC heat flow calculation method is introduced, based on the new heat flow measurement. TM-DSC results obtained using the new heat flow measurement and TM-DSC method are nearly independent of modulation period, allowing TM-DSC experiments to be performed at shorter periods with substantially higher average heating rates. Experimental results are shown that demonstrate the claimed improvements.