An Advanced Heat Flux DSC Operated in the Power Compensation Mode

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The instrument presented by Boersma in 1955 [1] can be considered the starting point for the development of disk type heat flux differential scanning calorimeters (DSC). In this type of DSC, a single furnace contains thermocouples or heat flow sensors with positions for refence and sample. This type of DSC has been further developed by commercial suppliers and is widely used. One of the advantages of this type of DSC is the high sensitivity and robustness.

The alternative power compensated DSC technique was first developed first by O'Neil in 1964 [2]. In this approach, the power required for compensate for heat is measured. The measurement system consists two small furnaces installed in a cooled metal block. This concept is used for conventional DSC and fast DSC using chip calorimeters (Flash DSC).

An advantage is the relatively short signal time constant, τ, which is given not only by the heat transfer conditions in furnace and sample, but also by the parameter of the controller of the difference temperature.

The new DSC type presented is based on a conventional heat flux DSC, which has been extended with additional heating elements and temperature sensors for power compensation. This new DSC type was developed to combine the robustness of the heat flux DSC with the signal time constant of a power compensated DSC. The new developed instrument has electrical power calibration for outstanding accuracy, small time constant for high resolution, improved sensitivity and excellent baseline stability.

The performance of this device is demonstrated using heat capacity measurements and fast transformations as examples.

[1] S.L. Boersma, A theory of differential thermal analysis and new methods of measurement and interpretation, Journal of the American Ceramic Society 38 (1955) 281-284.

[2] M.J. O'Neill, The analysis of a temperature-controlled scanning calorimeter, Analytical Chemistry 36 (1964) 1238-1245.