

Combined Ultra Fast Scanning and AC Calorimetry for Films in the Nanometer Range

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A differential AC-chip calorimeter capable to measure the glass transition in nanometer thin films is described. Due to the differential setup pJ/K sensitivity is achieved. Heat capacity can be measured for sample masses below one nanogram even above room temperature as needed for the study of the glass transition in nanometer thin polymeric films. The calorimeter allows for the frequency dependent measurement of complex heat capacity in the frequency range from 1 Hz to 1 kHz. Due to the small addenda, heat capacity ultra fast scanning experiments at cooling and heating rates up to 10000 K/s are possible too.

The glass transition in thin polystyrene films (100 – 4 nm) was determined at well defined experimental time scales. No thickness dependency of the glass transition temperature was observed within the error limits (± 3 K) - neither at constant frequency (40 Hz) nor for the trace in the activation diagram (1 Hz – 1 kHz).