Modeling and Analysis of Temperature Modulated Differential Scanning Calorimetry (TMDSC)

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Abstract

Temperature modulated differential scanning calorimetry (TMDSC), as an extension of conventional DSC, was invented in the early 1990s and has been used in a number of materials research areas. In this thesis, different aspects of TMDSC are studied, namely, (1) Effects of the contact thermal resistance on the observed specific heat, (2) Effects of the internal thermal resistance of the sample with a low heat diffusivity on the observed specific heat, (3) Effects of the types of non-reversing heat flow on the separability of the reversing and non-reversing heat flows, and (4) the separability of the reversing and non-reversing heat flows in TMDSC where the non-reversing heat flow is dependent on both time and temperature. It is found that both the contact and internal thermal resistances of the sample can significantly affect the observed specific heat under certain conditions. Good linearity of the TMDSC system is the pre-requisite to satisfactory separation of the reversing and non-reversing heat flows, it is also the pre-requisite to proper explanations of the imaginary part of the heat capacity. Keywords: TMDSC, temperature modulation, modeling, heat capacity, reversing heat flow, non-reversing heat flow

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