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TA1010 - Thermal behavior of caffeine by STA and DSC

Introduction

DSC is typically used to evaluate the glass transition, phase transition, crystallization and melting of a material. However, in measuring a material with an unknown thermal behavior, it is recommended to confirm its thermal behavior using the STA beforehand. Mass losses from a material are undesirable reactions that may cause contamination and damage to the DSC sensor. The STA is an indispensable tool in validating the mass changes of a material in a specific temperature range. Using the measurement results of the STA, the user can set the appropriate conditions for DSC measurement. In this application, the thermal behavior of caffeine is evaluated using the STA method to set the appropriate conditions for DSC measurement.

Measurement and results

Figure 1 shows the multiplot of STA and DSC measurement results of caffeine. In STA, a 5 mg caffeine was placed in an open Aluminum pan and was heated at 20°C/min from room temperature up to 300°C. STA measurement results revealed endothermic peaks at 163°C, 236°C and at 281°C due to phase transition, melting and evaporation, respectively. However, the TG curve indicates that mass losses are initially observed after the phase transition temperature and that a 100% mass loss is detected at 300°C, implying that sublimation and melting reactions have occurred simultaneously. Thru the STA measurement result of caffeine, DSC measurement was performed in a sealed Aluminum pan to suppress sublimation reaction during the melting process and to correctly obtain the enthalpy of the melting reaction which was 108 J/g.

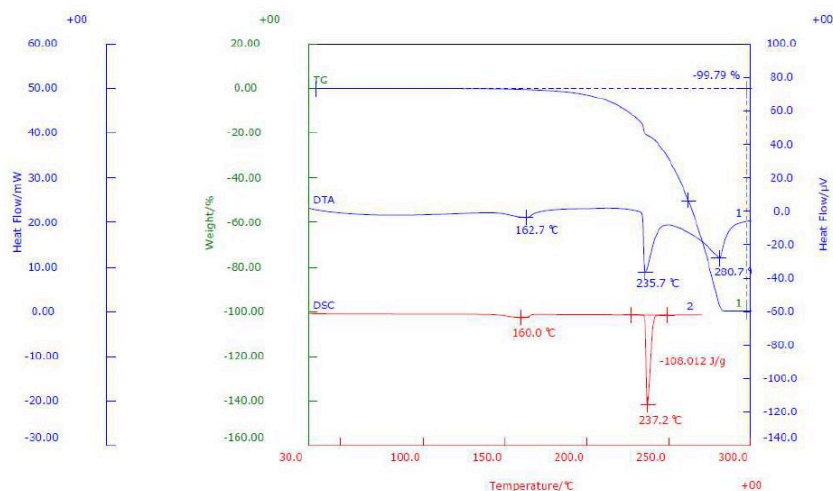
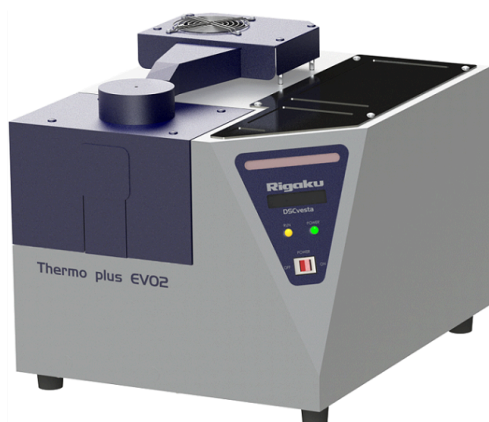


Figure 1: Multiplot of STA and DSC measurement results of caffeine.

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