Cross correlation of DSC / XRD on phase change thin film used in PCRAM technology

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In situ XRD (X-Ray Diffraction: structural analysis) and DSC (Differential Scanning Calorimetry: thermal analysis) offer the possibility of following state change induced by an environmental temperature surroundings. The coupling of DSC / XRD (concomitant or not) makes possible the correlation of thermodynamic and structural state evolution under the effect of thermal treatments. A more reliable characterisation is expected by giving new insights on a material behaviour: polymorphic phase transitions, fusion, crystallization or relaxation, segregation …
Phase Change Random Access Memories (PCRAM) are likely the successors to flash memories and show growing technological interest. As focus point of this type of memory, the amorphous/crystalline transition is crucial to store information. The phase changes and their stability are the topic of interest to improve the reliability of the memory devices. Many PCM materials are under investigations, and here in this work, the material case study is the $Ge_2Sb_2Te_5$ (GST), a reference material for PCRAMs [1].
The target of this study is to compare both analytical point of view as a first approach evaluation. a cross correlation of non-concomitant XRD / DSC techniques on a sample is presented and discussed: thermal in situ XRD analysis and thermal DSC analysis are carried out firstly and secondly under a same sample and in a comparable controlled thermal environment.
As commonly powder material sample is generally necessary for DSC [2], a specific thin film approach is investigated for DSC analysis. The discussion is open in this way under the support of instrumental, experimental and material considerations.

[1] F. Fillot et al., JAC, 51, 1691-1705, 2018
[2] C. Cabral et al., APL, 93, 071906, 2008