Calorimetric investigations of the transformations in metastable phases of metal alloys

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The phase behavior and microstructure of metal alloy significantly determine the material properties. During the rapid processing metastable phases are usually formed. Essential for the optimization of processing conditions is the knowledge of the kinetics of the phase transformation.

Various techniques of calorimetry are applicable for this task. Conventional differential scanning calorimetry (DSC) and temperature modulated DSC (TMDSC) can be used to identify various transformations and determine the thermodynamic properties of the phases involved. However, for the analysis of kinetics, these techniques are of very limited use limitations in the time resolution compared to the fast temperature scanning rates during processing.

For analysis of the kinetics, these techniques can be only used very limited because the approvable time resolution of these techniques dose not fits with the scanning rates of different processes. The fast differential scanning calorimetry (FDSC) using chip calorimeters based on MEMS technology open the opportunity to study the transformation kinetics in the require temperature and time range. Fast differential scanning calorimetry (FDSC) with chip calorimeters based on MEMS technology opens the possibility to study the transformation kinetics in the desired temperature and time range.

Here we focus on measuring the heat capacity of metastable phases of metal alloys [1,2], determining metastable phase diagrams [2], the kinetics of metallic glass formation [3], and studying the crystallization kinetics of a commercial Zr-based glass-forming alloy used for additive manufacturing [4].

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