Microsecond-pulse heating nanocalorimetry: quasi-static method

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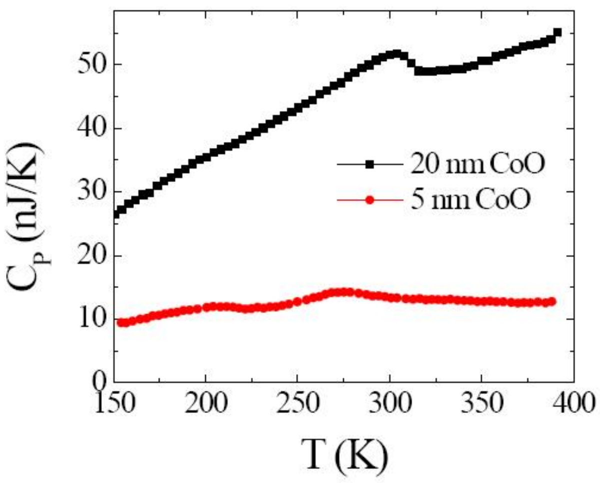
The use of membrane-based chip calorimeters has opened the way of studying size dependence of thermodynamic properties in nanomaterials. Among the different calorimetric methods implemented for chip, quasi-adiabatic nanocalorimetry [1] reports the better sensitivity per unit area, but do not offers the possibility of measuring heat capacity at constant temperatures as function other variables (time, magnetic field…) like AC-calorimetry [2]. We present a new operational method combining the better characteristics of both methods previously mentioned. In this method, the calorimetric cell, consisting of a silicon nitride membrane (~ 180nm thick) and a thin film metallic sensor, is heated by joule effect with train of current pulses (few µs width, ms separated) promoting local temperature scans that span few K over the base temperature. The possibility of multiple scan averaging and the huge heating rates accessible (up to 10^6 K/s) permits to reach exceptional heat capacity resolution of 100 pJ/(mm K √Hz). The method is demonstrated by characterizing the antiferromagnetic transition in CoO thin film samples of 5 and 20 nm thick.



References

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