Calorimetric Study on Cu-Al-Ni Shape Memory Alloys

A. López-Echarri[C, S], I. Ruiz-Larrea and J.M. San Juan
Sección de Físicas Facultad de Ciencia y Tecnología, Universidad del País Vasco, Bilbao, Spain
a.lopezecharri@ehu.es

A. Fraile-Rodríguez
Paul Scherrer Institut, Villigen PSI, Switzerland

Calorimetric measurements on Cu-Al-Ni metallic alloys are presented. Up to now, the conventional DSC technique has been the only experimental source for the specific heat behaviour of these shape memory alloys and for the enthalpy associated to the martensitic phase transition. In this work, the specific heat of some selected compositions has been determined by means of DSC, AC Calorimetry and Adiabatic Calorimetry around the phase transformation. The dynamical characters of the various experimental methods together with the influence of the latent heat associated with the strong first order character of this transformation are discussed. These facts could explain the apparent dependence of the AC calorimetric results on the heating or cooling rates [1], a kind of effect also observed when dynamic experiments, such as internal friction measurements [2], are performed on these alloys. On the contrary, data obtained by Adiabatic Calorimetry between equilibrium states or by using very slow heating rates (down to 0.3ºC/hour) do not show evidence of any intrinsic kinetic effect associated to these kind of martensitic transformations.

The specific heat values throughout the temperature range from 50 to 350 K agree with those expected from a metallic alloy and can be easily modelled by the use of a sum of simple Debye functions. By this procedure, an accurate estimation of the normal lattice contribution to the alloy specific heat is attained and reliable data for the phase transformation heat is guaranteed. In addition, the anharmonic crystal behaviour as a function of the temperature can be obtained. Physical quantities such as the Gruneisen parameter and the isothermal compressibility are easily calculated.

[1] A. Fraile-Rodríguez, I. Ruiz-Larrea, A. López-Echarri, and J. San Juan, *Scripta Materialia* **54**, 1199 (2006).
[2] R. B. Pérez-Sáez, V. Recarte, M. L. Nó, *J. San Juan, Phys.* Rev.B **57**, 5684 (1998).