

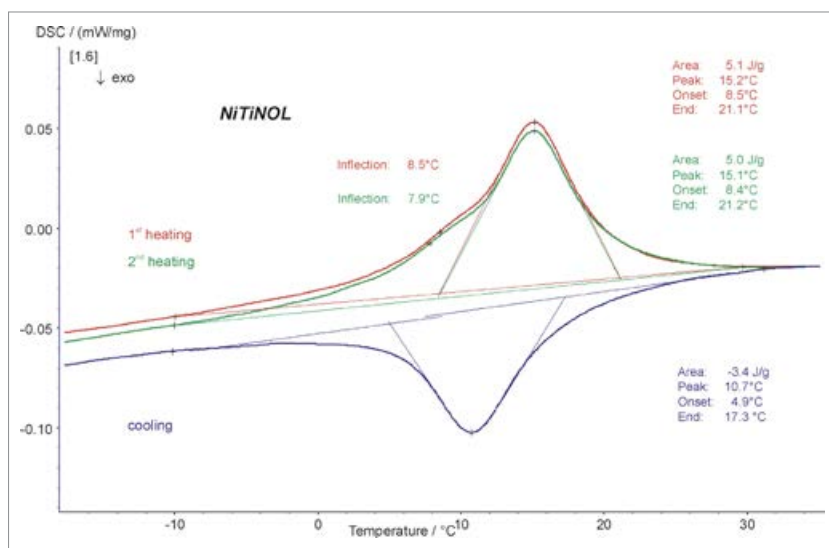
APPLICATION SHEET

METALS/ALLOYS – ELECTRONICS/MEDICAL

SHAPE MEMORY ALLOY

After a sample of SMA has been deformed from its “original” conformation, it regains its original geometry by itself during heating (one-way effect) or, at higher ambient temperatures, simply during unloading (pseudo-elasticity). These extraordinary properties are due to a temperature-dependent martensitic phase transformation from a low-symmetry to a highly symmetric crystallographic structure. Those crystal structures are known as martens-

ite and austenite. The range of applications for SMAs has been increasing in recent years, with one major area of expansion being medicine: for example, the development of dental braces that exert a constant pressure on the teeth. However, these materials are not currently appropriate for applications such as robotics or artificial muscles, due to energy inefficiency, slow response times, and large hysteresis.



Instrument

DSC 204 **F1** Phoenix®

Test Conditions

Temperature range	-50 ... 50°C
Heating rate	10 K/min
Atmosphere	Nitrogen at 40 ml/min
Sample mass	5.34 mg
Crucible	Aluminum, pierced lid

Results

The extraordinary properties of shape memory alloys are based on the structural changes. Every phase transition is associated with a heat exchange and can therefore be studied by means of DSC. The analysis of shape memory alloys with several heating and cooling cycles can not only determine the phase transition temperature but also prove the reversibility of these phase transitions. Comparing the results of the first and second heatings, the results confirm an identical peak shape and reversible values for the transition temperatures as well as for the transition enthalpy.