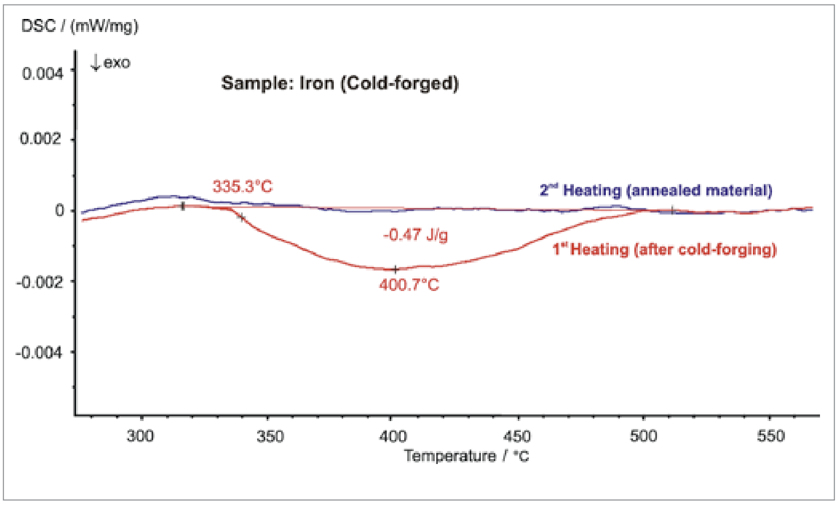
APPLICATION **SHEET**

METALS/ALLOYS – AUTOMOTIVE

COLD-FORGED IRON

Forging is one possible way for shaping of a metal by plastic deformation. The conventional forging process is done at high temperatures, which makes metals easier to shape and less likely to fracture. Commonly, iron or steel parts are forged at temperatures where the metal becomes malleable (typically red hot). Cold forging is done at low temperatures. Once the final shape has been forged, iron and steel in particular often get some type of heat treatment. This can result in various degrees of hardening or softening depending on the details of the treatment. During heat treatment defects in the crystal structure anneal or new faces are formed, resulting in a small energy release. This extremely weak exothermal effects can be analyzed employing a NETZSCH DSC or STA system.



Instrument

DSC 404 C *Pegasus*®

Test Conditions

Temperature range	200 … 600°C
Heating/cooling rates	20 K/min
Atmosphere	Argon at 50 ml/min
Sample mass	335 mg
Crucible	Pt
Sensor	$DSCc_p$ type S

(reference side was filled with an already annealed sample)

Results

Presented in the plot is the specific heat flow rate measured on a cold-forged iron sample. During the first heating run, an exothermal effect was detected at 335°C (extrapolated onset). The peak temperature was at 401°C. At approx. 500°C, the exothermal reaction was finished. The energy release during this relaxation reaction was 0.47 J/g. The effect is not visible in the measurement of the annealed material. Those tests require a vacuum-tight instrument and pure purge gases (to avoid oxidation effects which can occur in a similar temperature range), as well as a high performance DSC-sensor, with high sensitivity, low noise and good baseline drift and stability. These requirements are standard features of the NETZSCH high-temperature DSC and STA systems.

NGB · AS · 132-2006 · EN · 07/13 · Technical specifications are subject to change.

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