

APPLICATION SHEET

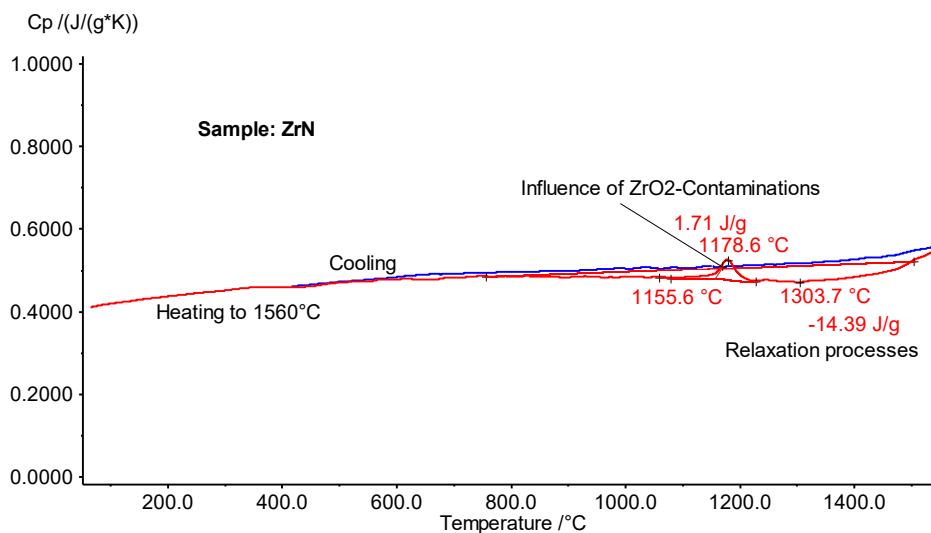
Ceramics · Nuclear Research
DSC 404 Pegasus®

Zirconium Nitride

Introduction

Zirconium nitride is a hard refractory ceramic with a high melting point (2960°C) and high density (7.09 g/cm³). It has been used recently as an alternative to titanium nitride for coating drill bits. Both coatings are supposed to keep the bit sharper and cooler during cutting. Due to the high temperature stability and the stability against nuclear

radiation, it is one of the materials considered for nuclear applications. It can, for example, be used as a matrix material in the production of nuclear fuel systems. One of the advantages of the material is that it has a low ability to absorb source neutrons, which are driving the spallation process. For safety process control, however, the thermo-physical properties must be known.



Test Conditions

Temperature range: RT ... 1560°C
Heating/cooling rates: 20 K/min
Atmosphere: Argon at 50 ml/min
Sample mass: 191 mg
Crucible: Pt with lid
Sensor: DSC type S

Test Results

The specific heat flow increases from slightly above 0.4 J/(g·K) at room temperature to 0.55 J/(g·K) at 1500°C. The slight change in specific heat indicates that the Debye-temperature is on a low level for this nitride ceramic. During heating, a slight decrease in specific heat was observed above 900°C. This effect is caused by relaxation processes in the non-stoichiometric sample material. During cooling, a continuous decrease with a decreasing temperature was measured. Starting at 1156°C (extrapolated onset), a small endothermic peak overlaps the specific heat. This peak is caused by a phase change in the zirconium oxide, occurring inside the sample as a contamination.