

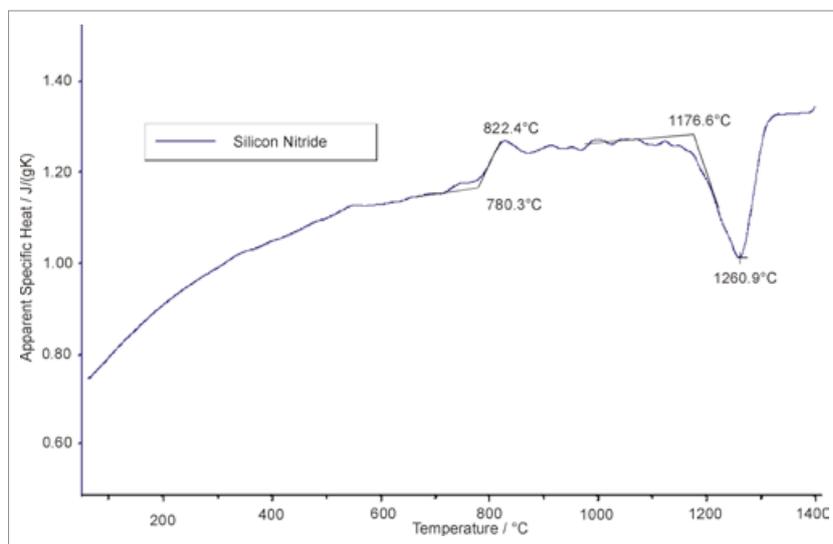
APPLICATION SHEET

CERAMICS – AUTOMOTIVE

SILICON NITRIDE (GREEN BODY)

Silicon nitride (Si_3N_4) is a hard, solid substance, that can be obtained from a direct reaction between silicon and nitrogen at high temperatures. Silicon nitride ceramics have a relatively good thermal shock resistance compared to other ceramics. Due to this, rollers made of silicon nitride ceramics are sometimes used in high-end skateboard bearings or in ball bearing systems of space ships (space shut-

tle). In microelectronic technology, silicon nitride is usually formed using chemical vapor deposition (CVD) method, or one of its variants, such as plasma-enhanced chemical vapor deposition (PECVD). It is usually used either as an insulator layer to electrically isolate different structures or as an etch mask in bulk micromachining. It has also been discussed to use silicon nitride materials for engine valves.



Instrument

DSC 404 C Pegasus®

Test Conditions

Temperature range	RT ... 1400°C
Heating rate	20 K/min
Atmosphere	Argon at 60 ml/min
Sample mass	approx. 40 mg
Crucible	Pt with Al_2O_3 lid and lid
Sensor	DSC type S

Results

Presented in the plot is the measured specific heat of a debinded silicon nitride green body (mixture of silicon nitride powder without organic binders). Between 780 and 822°C, an endothermic step can be seen. This step is due to the glass transition of an amorphous phase mainly created by silicon dioxide contamination inside the green body. At 1177°C (extrapolated onset), an exothermic effect starts. This is due to the cold-crystallization of the amorphous components inside the material. This example clearly demonstrates how impurities can influence the thermal behaviour of such a ceramic material.