



PIEZOCRYST



GaPO₄

Stability

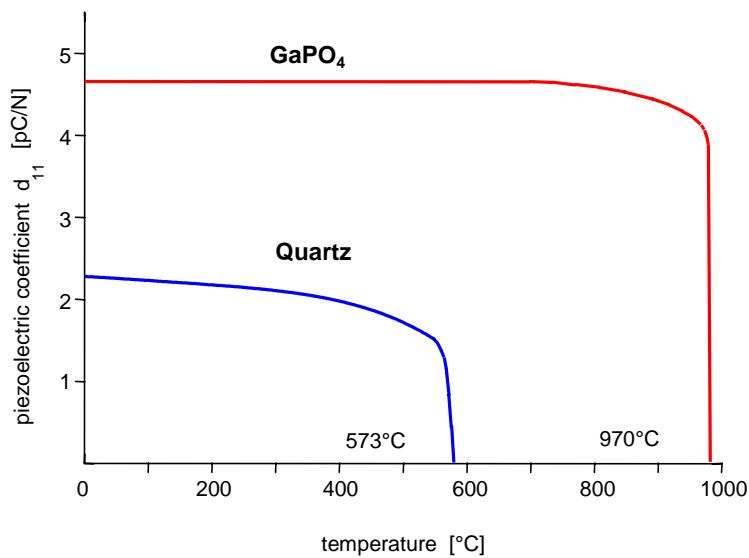
Mechanical Stability

- Proven stability for 10 000 h at 200°C, 90 bar mean pressure
- Guaranteed 100 000 000 pressure cycles 1 - 250 bar
- Successful SAW measurements at 600°C for 250 h without any change of crystal material
- BAW measurements up to 720°C documented high suitability for temperature sensors or QCM applications

Thermal Stability

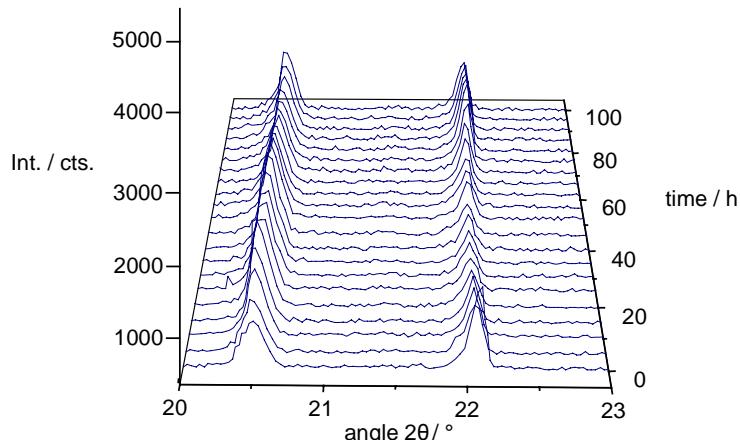
- Excellent thermal stability of piezoelectric constants, phase transition just at a temperature of 970°C

Comparison between the piezoelectric constant d_{11} of GaPO₄ and quartz



- 100 h long term test at 950°C showed no sign of structure changes

X-ray investigation of GaPO_4 crystals, 950°C, 100 h+



- High insulation resistance proving crystal stability of GaPO_4

Comparison between GaPO_4 and quartz

T [°C]	GaPO_4 (x-cut)	Quartz* (x-cut)
	$\rho [\Omega\text{cm}]$	$\rho [\Omega\text{cm}]$
500	$>10^{11}$	$>10^9$
700	$>10^9$	—
900	$>10^7$	—

* Quartz is changing its crystal structure at 573°C

Storage / Durability

- GaPO_4 crystals can be stored under ambient conditions for years
- Humidity does not harm the crystal material

Conclusion

10 years of successful use under extreme conditions have shown the high stability of GaPO_4 crystals

Literature

- G. Gautschi, "Piezoelectric Sensorics", Springer, Berlin, 2002
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- C. Reiter et al., "Crystal Thermometer for Temperatures up to 970°C"; SENSOR 2003 proc, pp 109-113 (2003)
- H. Thanner et al., "GaPO₄ used for high temperature microbalances", 15th EFTF Proc., pp 93-96 (2001)
- P.M. Worsch et al., "High temperature X-ray powder diffraction study of the phase transition between the α -Quartz and β -Cristobalite like phase of GaPO_4 ", Material Science Forum, Vols. 321-324, pp 914-917 (2000)