Langasite Main Properties

Langasite – or “LGS” for short - is a piezoelectric crystal of the same crystal class as quartz. As opposed to quartz it has no phase transition up to the melting point at 1475°C. Therefore it is an excellent candidate for high temperature applications in sensors.
LGS has a piezoelectric factor d_{11}, which is about 2.7 times that of quartz., which allows to realize Piezo sensors with significantly higher sensitivity.
As the piezoelectric coupling factor is 2.3 to three times that of quartz, resonators with high pullability can be manufactured with this material, having a temperature stability and a Q-factor, which are in the same order of magnitude as those of quartz resonators.
Langasite crystals are synthetically grown by the Czochralski method in boules up to 100 mm diameter. LGS has excellent thermal, piezoelectric and dielectric properties and is resistant to many chemicals.
The main applications of LGS include

- Surface Acoustic Wave (SAW) Sensors, Bulk Wave Sensors, and Piezo static Sensor elements, for high sensitivity and high temperature applications
- Crystal Units as Bulk Wave (BAW) resonators
- SAW devices for frequency control and selection
- Piezoelectric filters, both discrete and monolithic

	Langasite (LGS)	**α - Quartz**
Chemical formula	$La_3Ga_5SiO_{14}$	SiO_2
Crystal space group	32	32
Density	5.748 kg m^{-3}	2.648 kg m^{-3}
Curie Temperature	-	573.3 °C
Melting Point	1475 °C	1723 °C
Moh’s Hardness	6.5	7.0
Dielectric constants @ 1 MHz	$\varepsilon_{11}/\varepsilon_0 = 18.99$ $\varepsilon_{33}/\varepsilon_0 = 50.44$	$\varepsilon_{11}/\varepsilon_0 = 4.52$ $\varepsilon_{33}/\varepsilon_0 = 4.68$
Coefficient of thermal expansion	$\alpha_{11} = 5.11 \cdot 10^{-6}$ / K $\alpha_{33} = 3.16 \cdot 10^{-6}$ / K	$\alpha_{11} = 7.64 \cdot 10^{-6}$ / K $\alpha_{33} = 14.0 \cdot 10^{-6}$ / K
Piezoelectric charge coefficient	$d_{11} = 6.25 \cdot 10^{-12}$ C N^{-1} $d_{14} = -3.65 \cdot 10^{-12}$ C N^{-1}	$d_{11} = -2.3 \cdot 10^{-12}$ C N^{-1} $d_{14} = -0.67 \cdot 10^{-12}$ C N^{-1}
Piezoelectric strain coefficient	$e_{11} = -0.4365$ C m^{-2} $e_{14} \approx 0.1$ C m^{-2}	$e_{11} = 0.171$ C m^{-2} $e_{14} = -0.0436$ C m^{-2}
Coupling factor for BAW k^2	15.8 % (Y-cut)	7.0 % (AT-cut)
Coupling factor for SAW k^2	0.32 %	0.11 % / 0.16 %
Elastic stiffness [in 10^{10} N m^{-2}]	$C_{11} = 18.92$ $C_{12} = 10.49$ $C_{13} = 9.78$ $C_{14} = 1.45$ $C_{33} = 26.33$ $C_{44} = 5.34$ $C_{66} = 4.23$	$C_{11} = 8.674$ $C_{12} = 0.699$ $C_{13} = 1.191$ $C_{14} = -1.791$ $C_{33} = 10.72$ $C_{44} = 5.794$ $C_{66} = 3.99$
Frequency Constant for BAW N = f / t	1380 kHz·mm (Y-cut)	1660 kHz·mm (AT-cut)

Values are collected from various publications

AXTAL GmbH & Co. KG
Wasemweg 5
D-74821 Mosbach
Germany

web : www.AXTAL.com
fon : +49 (6261) 939834
fax : +49 (6261) 939836
e-mail: info@axtal.com