

# Quartz Products & Properties



Momentive Performance Materials is a leading producer of fused quartz products. These materials cover a wide variety of applications. In addition, we can tailor the properties of our fused quartz further to meet even more demanding requirements. Our products cover several applications for tubing, crucible and ingot fused quartz including, but not limited to, semiconductor, lamp, and fiber optics.

## Selected Products Provided by Momentive

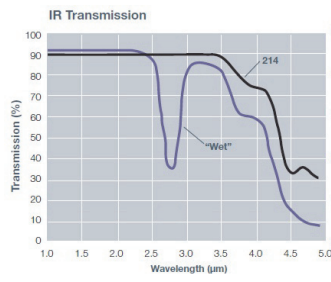
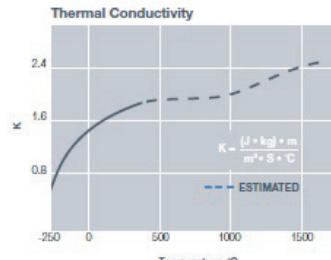
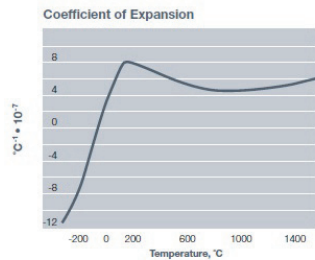
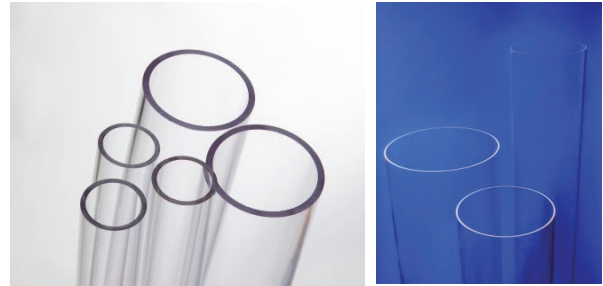
Boule		Lamp Tubing	
124	High Quality Natural	214	High Quality Natural
HDO	High Density Opaque	244	High Purity Natural
012	Synthetic	021	Synthetic
i21	Near Defect Free	219 or 254	UV blocking

Crucibles		Large Diameter Tubing	
530	Std. High Quality	214	Large Diameter Natural
588	High Purity Natural	224	Low Alkali Natural
590	Synlined High Purity	244	Low Al Natural

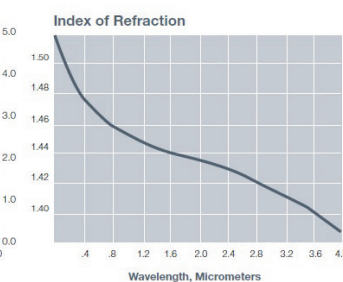
## Available Forms

Momentive's natural and synthetic grade quartz are available in the following forms, providing increased flexibility to support a variety of applications:

- Large solid ingot (72" diameter, 21" height)
- Tubing (up to 600mm diameter)
- Rod (up to 50mm diameter)
- Crucible (up to 36" diameter)
- And other shapes



This chart shows how low OH- content fused quartz transmits more energy compared to "well" material of the material. The IR energy transmission of fused quartz is affected by the presence or absence of OH- absorption band at 2.7 $\mu\text{m}$ . The overall effect is an increase in the efficiency of IR heating through quartz. Source: Momentive.



## Material Properties

With advanced formulation capabilities, Momentive can modify various quartz properties and perform analytics to characterize the final product.

- Transmission spectra
- Index of refraction and dispersion
- Laser properties based on rare earth identity / content
- Maximum application temperature
- Coefficient of thermal expansion
- Thermal shock resistance
- Chemical durability
- Others

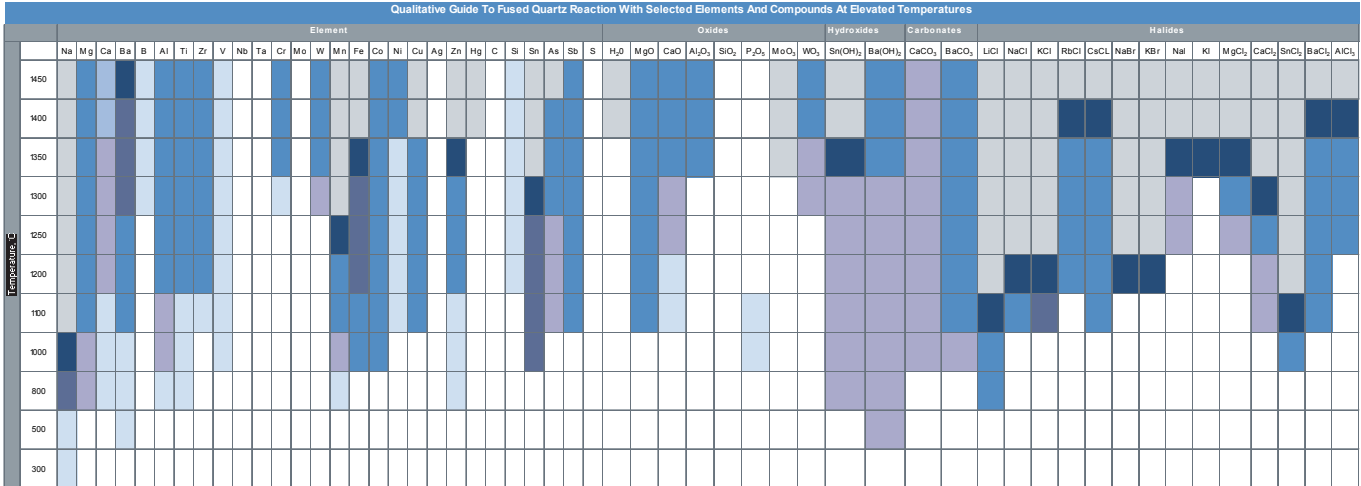
## Low Hydroxyl (OH<sup>-</sup>)

Momentive's quartz products can withstand wide thermal gradients and chemical environments due to:

- Hydroxyl (OH<sup>-</sup>) content of less than 10 ppm
- Minimal sag rate at diffusion temperatures
- Does not require special coatings

## Typical Properties of Momentive's Fused Quartz Tubing

	214	219	254
Density (g/cc)	2.2	2.21	2.21
Thermal Expansion Coefficient (cm/cm °C)	$5.5 \times 10^{-7}$	$5.9 \times 10^{-7}$	$6.7 \times 10^{-7}$
Softening Point (°C)	1683	1660	1615
Annealing Point (°C)	1215	1204	1163
Strain Point (°C)	1120	1106	1066
Index of Refraction	1.4585	1.456	1.46
Specific Heat (J/kg °K) (0-50°C)	670	700	690
Compressive Strength (Pa)	$>1.1 \times 10^9$	$0.94 \times 10^9$	$0.55 \times 10^9$
Young's Modulus (Pa)	$7.2 \times 10^9$	$7.5 \times 10^9$	$7 \times 10^9$
Electrical Resistivity (ohm cm @ 350 °C)	$7 \times 10^9$	$2.5 \times 10^{10}$	$5 \times 10^{10}$
Dielectric Constant (@ 1MHz)	3.75	5.8	6

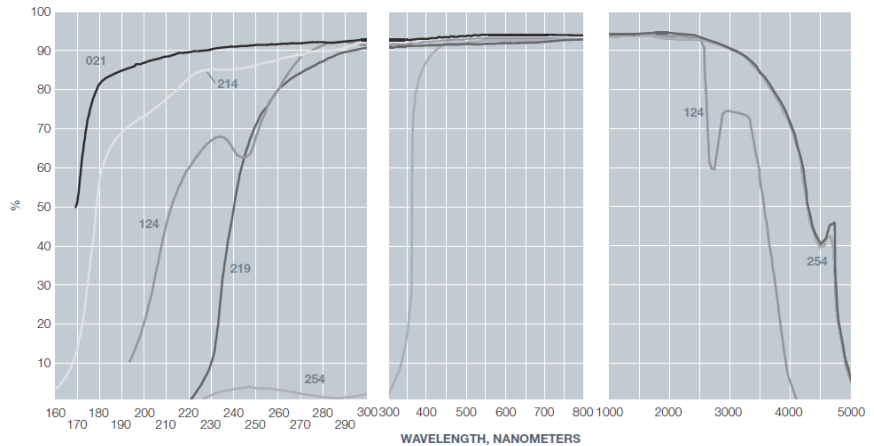


Visual Inspection Results

Legend:

No change	
No devitrification - But Coated or Stained By Test	
Some Spots of Devitrification	
Surface Devitrification	
Severe Devitrification	
Failure Due to Devitrification	
Not Tested at This Temperature	

Fused Quartz Average Transmittance Curves  
Type 124, 10mm thickness; all others, 1mm thickness (Includes Surface Reflection Losses)



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