

## Properties of TM Rod Materials

	Units	Test	Material Type		
			D-83XX	D-43XX	D-2000
<b>Physical</b>					
Density	g/cc	ASTM-C20	4.7	5.07	3.98

### Mechanical

Flexural Strength (MOR) (Mean)	MPa (psix10 <sup>3</sup> )	ASTM F417	140 (20.3)	155 (22.5)	225 (32.5)
Flexural Strength (MOR) (Mean-2SD)	MPa (psix10 <sup>3</sup> )	ASTM F417	100 (14.6)	135 (19.5)	185 (26.7)
Compressive Strength (Mean)	MPa (psix10 <sup>3</sup> )	ASTM C773	1201 (174)	972 (141)	1486 (215)
Compressive Strength (Mean-2SD)	MPa (psix10 <sup>3</sup> )	ASTM C773	968 (140)	496 (72)	941 (136)
Tensile Strength (Mean)	MPa(psix10 <sup>3</sup> )	ACMA Test #4	86 (12.4)	71 (10.3)	101 (14.6)
Tensile Strength (Mean-2SD)	MPa(psix10 <sup>3</sup> )	ACMA Test #4	72.3(10.4)	47.2 (6.8)	75.6 (10.9)
Elastic Modulus	GPa	ASTM C848	160	161	230
Shear Modulus	psix10 <sup>6</sup>		9.06	9.16	13.29
Poisson Ratio	-	ASTM C848	0.3	0.29	0.27
Hardness	Rockwell 45N	ASTM E18	64	76	63
Hardness	GPa (Kg/mm <sup>2</sup> )	Vickers ASTM E384	7.4 (757)	8.9 (908)	8.7 (884)
Fracture Toughness	Mpa*m <sup>1/2</sup>	Notched Beam	2.2	2	2.7

### Thermal

Coefficient of Thermal Expansion 25-1000 C	1x10 <sup>-6</sup> /C	ASTM E228 and ISO 6872	10.7	8.4	11.5
Coefficient of Thermal Expansion 25-200 C	1x10 <sup>-6</sup> /C	ASTM E228 and ISO 6872	8.9	6.3	9.1