

## Comparison of Aluminum, Titanium and Beryllium

Property	Beryllium	Titanium	Aluminum	Benefit
Speed of Sound, <b>c</b>	12,945 m/s	5,077 m/s	5,128 m/s	The frequency at which the first breakup occurs in any metal is analogous to the speed of sound through that metal. Beryllium delivers the highest Speed of Sound at nearly 2.5 times aluminum or titanium. As a result beryllium delivers significantly less HF distortion under load.
Young's Modulus, <b>E</b>	$310 \times 10^9$ Pa	$116 \times 10^9$ Pa	$71 \times 10^9$ Pa	A higher Young's Modulus equates to higher stiffness. A stiffer component bends less under stress, thereby reducing mechanical deformation (breakup) and shifting resonate frequencies outside the audible range. Beryllium performs best in this analysis at 2.67 times stiffer than its nearest competitor.
Density, <b><math>\rho</math></b>	1,850 kg/m <sup>3</sup>	4,500 kg/m <sup>3</sup>	2,700 kg/m <sup>3</sup>	Density measures mass per unit volume. A lower overall mass allows for greater acceleration, which increases both passband efficiency and high-frequency extension. Beryllium has the second lowest density-to-mass ratio of all the acoustically useful metals.
Tensile Strength (yield)	$240 \times 10^6$ Pa Yield	$140 \times 10^6$ Pa Yield	$90 \times 10^6$ Pa Yield	Tensile Strength measures a material's threshold of tensile stress before failure. A higher Tensile Strength means less of that material is required to achieve equivalent strength. With less material, mass is lowered and better overall transient response occurs. Beryllium's has the highest Tensile Strength of all the acoustic metals.
Poisson's Ratio, <b><math>\nu</math></b>	0.032	0.34	0.33	The Poisson's Ratio of beryllium is unusually low, resulting in a reduced coupling of sound waves from one mode of propagation to another. The ability to keep the different modes of propagation separated is of great importance in acoustics, especially at higher frequencies. In other words, a lower Poisson's Ratio better preserves the direction of applied force.