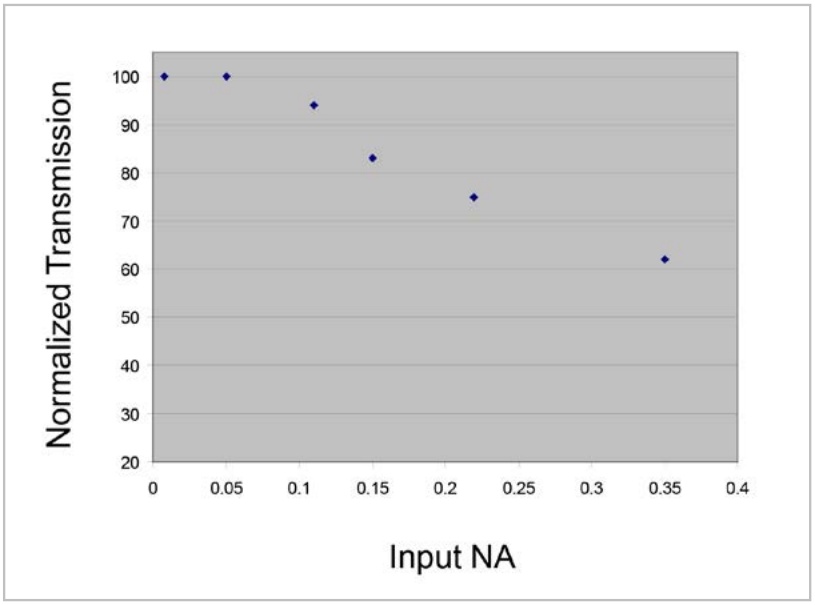
LASER COMPONENTS®

What is the NA of Sapphire Fiber?

The NA of a sapphire fiber is not well defined. If one assumes the fiber is perfectly circular in cross section and uniform in diameter as well as optically isotropic, then the theoretical NA for sapphire fiber in air should be 1.0. However, in reality the fiber has an approximately rounded hexagonal cross sectional shape (for the standard c-axis orientation), its surface is not perfectly smooth, and the sapphire crystal is uniaxial. For these reasons, the angular spread of the guided light increases with distance of propagation. Since the large angle rays make more bounces at the wall per unit length of propagation, the attenuation coefficient also increases as a result of surface scattering. For the same reason, the transmission for a given fiber decreases with increasing input NA. This behavior is illustrated in the figure below. In general, the drop-off in transmission will be less pronounced for shorter fiber length, larger fiber diameter and longer wavelength.

Relative Transmission of 1 m long 125 µm Sapphire Fiber vs. Input Numerical Aperture @ 633 nm



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