

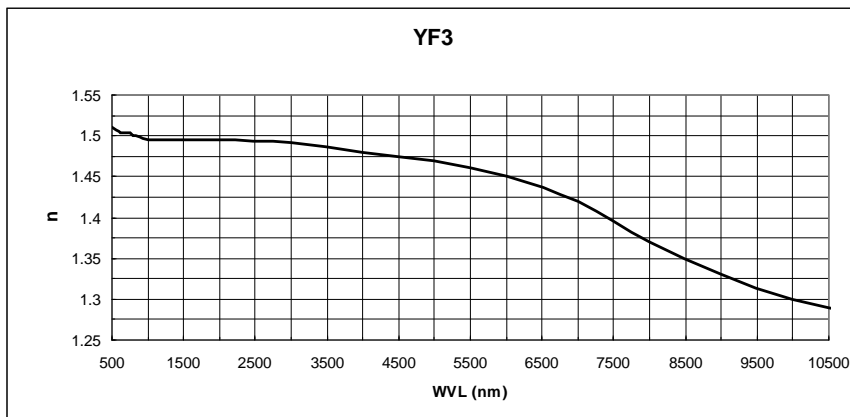
Yttrium Fluoride, YF₃ For Optical Coating

Applications

Yttrium fluoride, YF₃, produces low-index film layers that exhibit good transparency in the UV through infrared regions. The films are insoluble and show low stress, making YF₃ a useful substitute for ThF₄ in many IR applications. It can be combined in multi-layers with other fluoride compounds and with higher-index ZnS and ZnSe layers for AR and filter coatings out to wavelengths >10 μm. Its absorption at 10.6 μm is low, but limits its use to laser applications that do not require the highest damage thresholds.

Film Properties

Yttrium Fluoride films can be deposited from the melt by resistance-heated or electron-beam evaporation. Film density and refractive index increase with substrate temperature. Thicknesses greater than 2 μm will adhere to zinc sulfide, glass, and Germanium substrates heated to 250°C. Yttrium fluoride is insoluble, therefore making it suitable for humid conditions when applied hot. Water absorption bands of depth 2-5% are present at 2.8-3.2 μm and 5.6 -7.3 μm on colder substrates. When used in multi-layer combination with ZnS or ZnSe, the substrate temperature must be reduced to ~175°C to avoid the low sticking coefficients that those materials exhibit at higher temperatures. Amorphous films exhibiting low scatter can be deposited below 150°C substrate temperature, but adhesion and refractive index properties are compromised. Above ~250°C, the films become crystalline and harder, but they exhibit noticeable scatter and are more highly stressed.



The refractive index characteristic of a YF₃ film with high packing density. The intrinsic absorption at the long-wave edge is as follows: ~1% at 10 μm; ~3% at 11 μm; and ~5% at 12 μm.

Evaporation Parameters

Evaporation temperature	~900° C
Source Container	Alumina, Tantalum, Molybdenum
Rate	15 Å/sec.
Partial pressure of oxygen	~1 x 10 ⁻⁵ Torr
Substrate temperature	200° C to 250° C (see "Film Properties")

Evaporation Procedure

By E-beam: Melt material with a low power sweep until spitting and outgassing subside as a rate of 1Å/sec is approached (~15 min). Increase the power gradually to form a uniform melt before opening the shutter.

By resistance heating: Using a baffled box source that has a perforated top (similar to ThF₄ procedure), fill and heat to gradually approach evaporation temperature.

Physical Properties of Solid Material

Molecular Weight	145.9
Melting Point	1387° C
Color	White
Crystal Density	4.01g/cc

Ordering Information

For specific product information or to place an order, contact CERAC at ceracsales@beminc.com or by phone at +1-414-289-9800. Visit www.cerac.com for a complete list of global sales and service locations.

Forms and Sizes Available

Item Number	Purity	Description
Y-1049	99.9	3-12 mm melted pcs