HORIBA
Applications Note #33
LA-series Particle Size Analyzers

YTTRIUM OXIDE (Yttria, Y_2O_3)

Yttrium occurs in nearly all of the rare-earth minerals. It is recovered commercially from monazite sand, which contains about 3%, and from bastnasite, which contains about 0.2%. The metal is now produced mainly by reduction of the fluoride with calcium metal.

Yttrium oxide is one of the most important compounds of yttrium and accounts for the largest use. It is widely used in making YVO_4 europium, and Y_2O_3 europium phosphors to give the red color in color television tubes. Many hundreds of thousands of pounds are now used in this application. Yttrium oxide also is used to produce yttrium-iron-garnets, which are very effective microwave filters.

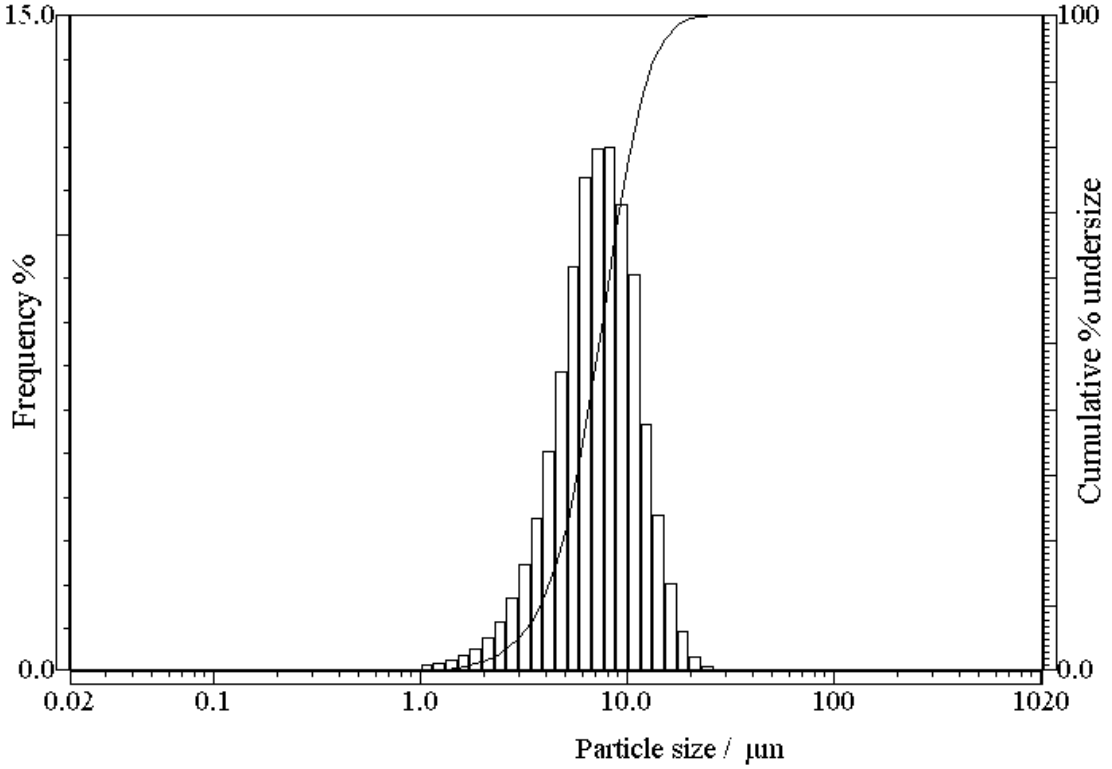
It also has potential use in ceramic and glass formulas, as the oxide has a high melting point and imparts shock resistance and low expansion characteristics to glass. Hard, dense layers are deposited by electron-beam evaporation or sputtering. Typical applications are protection of aluminum and silver mirror coatings, intermediate layer in wide band visible AR coatings and for XeCl (308 nm) laser AR and dielectric mirror designs.

Yttrium oxide is the thermodynamically most stable oxide and is suitable for extreme operation conditions. It is used as a coating in metal production. Yttria is often used with zirconia to form Yttria Stabilized Zirconia (YSZ).

Yttria has the common characteristics of ceramics that are not found in metallic or organic materials, including high hardness (Next to Diamond), high mechanical strength, high temperature stability, chemical resistance, erosion resistance, low electrical conductivity

As with all ceramic materials, performance of the final product directly depends on the particle size of the ceramic material. Mechanical strength of the final part depends on the ability of the particles to pack to the appropriate density. An excess of large particles can form discontinuities in the body, which are a weak point. In products where gas or liquid flow through the material is important, the packing density of the individual particles defines the porosity of the final product.

Yttria is a fairly easy material to analyze using Horiba's LA-series particle size analyzers. Samples are usually dispersed in water, with 0.1% sodium pyrophosphate added as a surfactant. A short period of ultrasonics is usually required to disperse agglomerates, particularly in the finer grades.



The yttrium oxide sample shown above is used as a coating in light bulbs to disperse the light from the element.

Filename:	4341-572
Median:	7.226 µm
Mean:	7.731 µm
S.D.:	3.475 µm
D(10%):	3.739 µm
D(90%):	12.330 µm