IMPORTANT INFORMATION

Spectralon Design and Machining Guidelines

I. Introduction & Purpose

The unique nature of Spectralon® requires some guidelines when designing mechanical parts. This datasheet contains helpful hints about mechanical design and machining of Spectralon parts.

II. Design Considerations

- **Spectralon is a porous, flexible, thermoplastic material**. As such, it is prone to distortion and stress, particularly in applications requiring thin sections or large dimensions.

- **Temperature is an important variable** to consider in part design. Manufacturing, inspection, and use in service temperatures should be considered.

- **The coefficient of linear expansion of Spectralon** is between 5.5 – 6.5x10^{-5} in/in ^{O}F, depending on reflectance grade. Delecate shapes often show more delicate and vary less with temperature.

- **Spectralon is available in different reflectance levels, from 2% to 99%.** In general, higher reflectance grades are more mechanically robust than lower reflectance grades. Higher reflectance graes of Spectralon also have higher rates of thermal expansion. Lower reflectance grades are more delicate and vary less with temperature.

- **The standard tolerance for dimensions** up to 4.00 inches (10.16 cm) on Spectralon parts is a total of 0.010 in (0.254 mm). This can be expressed a +/- 0.005 in. (0.127 mm), +0.000/-0.010 in. (0.254 mm), or any combination including at least 0.01 in. (0.254 mm) of tolerance.

  Dimensions should have larger tolerances whenever possible. For dimensions larger than 4.00 in. (10.16 cm), add +/- 0.001/in. (.0254/mm). Example: A 12 in. (30.48 cm) dimension will have (+/-0.005 in.)+(+/-0.008)=+/-0.013 in. (+/-0.127 mm)+(+/-0.2032 mm)=0.3302 mm total tolerance.

- **Spectralon tolerances apply at the time of machining**. Spectralon parts may distort over time due to internal stresses in the material. It is often useful to specify a constrained state for part inspection. This constrained state should simulate the final use of the part.

- **It is possible to use interfernce fits in Spectralon** (dowel pins, etc.). Close fits may require tapered leads on round parts or matched sets of mating parts.

- **Fastening methods for Spectralon** parts include various brackets, thread inserts, tapped holes, and self tapping screws. These methods are less effective with lower reflectance grades of Spectralon.

- **Spectralon is sensitive to contamination** from grease and oil. Cotton or powder free vinyl gloves must be worn when handling Spectralon.

- **Thin sections of Spectralon have some degree of translucency**. Seven (7) mm is typically the minimum thickness recommended ot optimum reflectance. Spectralon can be doped with barium sulfate to limit translucency and achieve high diffuse reflectance. Contact Labsphere for further information.

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SPECTRALON DESIGN AND MACHINING GUIDELINES

III. Machining Considerations

- **Spectralon is an optical standard** and should be handled in much the same way as other optical standards. Although the material is quite durable, care should be taken to prevent contaminants such as finger oils from contacting the material's surface. Always wear clean cotton or powder free vinyl gloves when handling the material.

- **Since Spectralon is porous to non-polar materials and solvents**, it must be kept free from all oil and grease during the machining process. The machining process. The machining tools, lathe and miller should be thoroughly cleaned with spectrophotometric grade ethanol before machining the Spectralon material.

- **Lubrication or cooling of the material is generally unnecessary while machining**. However, if cooling is required, a stream of distilled water or clean dry air should be used.

- **Spectralon is softer than Delrin, polycarbonates and many other resins**. It should be chucked in the lathe jaws as gently as possible to avoid compression. A combination of high tool/lathe speed, with a slower material feed rate will yield the best machining results.

PHYSICAL AND THERMO-OPTICAL PROPERTIES OF SPECTRALON

Property	ASTM Test	Value
Density	**	1.25 – 1.5 g/cm^3
Water Permeability	D-570	<0.001% (hydrophobic)
Hardness	D-785	20 – 30 Shore D
Thermal Stability	**	To 350^{O}C
Coefficient of linear expansion	D-696	5.5 – 6.5 x 10^{-5} in/in ^{O}F, 1 x 10^{-4} cm/cm ^{O}C
Vacuum Stability	**	No outgassing, except entrained air
Flammability	**	Non-flammable (UL rating V-O)
Yield Stress	D-638	208 psi
Ultimate Stress	D-638	891 psi
Young's Modulus	**	35,774 psi
Elongation at 2 in.	D-638	42.8%
Elongation at failure	D-638	91.3%
Poisson's Ratio	E-132	0.296
Deformation under load	D-621	13.3% @250 lbs.
	D-621	22.6% @500 lbs.

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