Importance of Sample Preparation

Proper sample preparation is the first step in accurate measurement.

Since the size of the sample is used to calculate the permittivity and permeability, the sample size measurement error directly affects the permittivity and permeability. Therefore, in order to accurately evaluate material properties, it is necessary to accurately measure the size. Also, in order to accurately measure the size, it is ideal that the cross sectional area is uniform if a sample has a rod like shape, and the thickness is uniform if it is a flat plate.

Material preparation overview for cavity resonator

It is basically to machine the sample into a rod shape. The recommended sizes are as follows. For samples with anisotropy, you can evaluate the difference in dielectric constant due to anisotropy by changing the direction of sample extraction.

Size Recommendation: Cavity

Resonator	WxD (mm)	L (mm)
1- 5.8 GHz	1.5 x 1.5	80
10 GHz		60

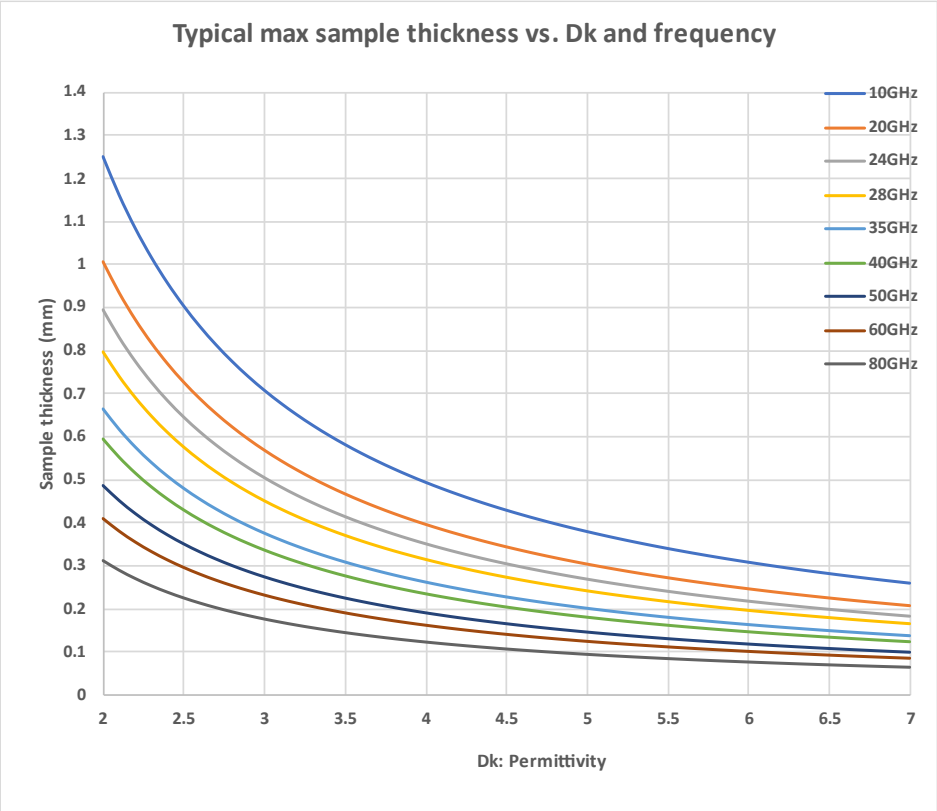
Importance of Sample Preparation

Material preparation overview for split cylinder resonator

It is necessary to process the sample into a plate shape.

Thickness： The optimum thickness of the sample depends on the dielectric properties of the sample and the resonator to be used, but 100 µm is a good starting point. As seen in the following chart, the higher the frequency and Dk value, the thinner the sample needs to be. Note that the sample may need to be significantly thinner than the values in the chart if the material has relatively high loss (tan δ >0.01). On the other hand, in case of thin samples, such as 10 µm, the thickness measurement error, which directly affects permittivity measurements, can be very significant.

Size： 10 GHz: 62 mm x 75 mm, Others: 34 x 45 mm



Material preparation overview for free space method

It is necessary to process the sample into a plate shape. The recommended size will change according to the measurement frequency and permittivity/permeability of the material.

Thickness: One quarter wavelength is optimal. (Wavelength shortening 1 / √ (relative permittivity / relative permeability) in the sample need to be considered.)When it gets thicker, the error due to multiple reflection inside the sample can get significant.

Size: Diameter more than 6 wavelength is recommended. If 60 mm or more in diameter, it is easy to fix to the fixture.