ALMA Memo 273

FTS Measurements of Eccosorb MF112 at Room Temperature and 5 K from 300 GHz to 2.4 THz

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Measurements have been made of a 19.7 mil thick sample of Emerson and Cumming absorber MF112. The sample was machined from a recently purchased (9/98) rod of 1 inch diameter stock material. Transmittance spectra were taken with the sample at room temperature and cooled to 5 K with a Brucker IFS113V spectrometer. They are given in Figure 1 over the range 300 GHz to 2.4 THz (10-80 wavenumbers). These were normalized with background scans taken with no sample present. In both cases, the sample was physically removed from the beam, in the 5 K case within the sample Dewar, so that instrumental effects of the Dewar windows were also removed.

MMICAD[1] was used to fit the absorption coefficient and refractive index over the range 450-1500 GHz as outside this range the signal-to-noise ratio of the interferogram is too low. The refractive index of the material is determined to be 2.28 (ε_r=5.2) for the room temperature sample. For the 5 K sample the refractive index changes to 2.24 (ε_r=5.0). The power absorption coefficients for both samples determined from the data are given in Figure 2 for the 300 - 2400 GHz range.

As the absorption coefficient, α, is a function of frequency, MMICAD was used to fit it in the range 450-1500 GHz to a polynomial of the form $\alpha=A+Bf+Cf^2+Df^3$, where f is the frequency in GHz and A, B, C and D are given in the table, and the fits are shown in Figures 3 and 4.

Sample temperature	A	B	C	D
For α in cm^{-1}				
5 K	0	$2.46*10^{-2}$	$2.12*10^{-5}$	$-5.07*10^{-9}$
300 K	0	$3.94*10^{-2}$	$1.82*10^{-5}$	$-4.61*10^{-9}$
For α in dB/cm				
5 K	0	0.107	$9.2*10^{-5}$	$-2.2*10^{-8}$
300 K	0	0.171	$7.9*10^{-5}$	$-2.0*10^{-8}$

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[1]MMICAD is a microwave circuit analysis and optimization program from Optotek Ltd., Kanata, Ontario, Canada.

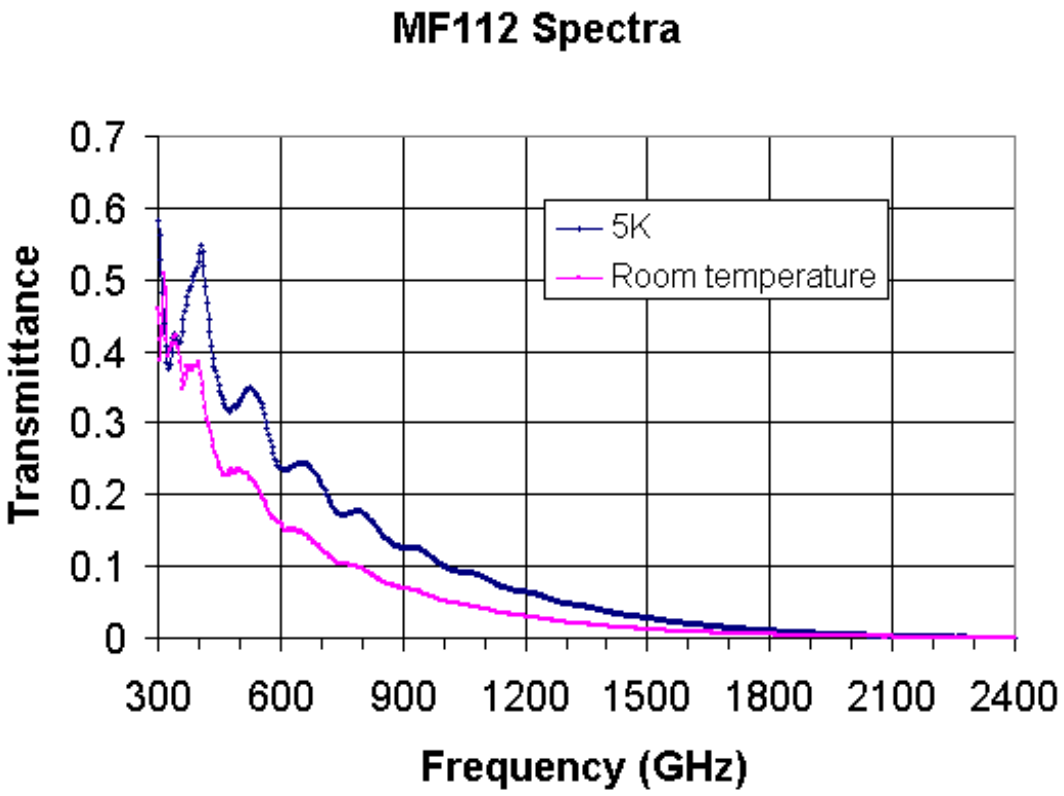

Figure 1

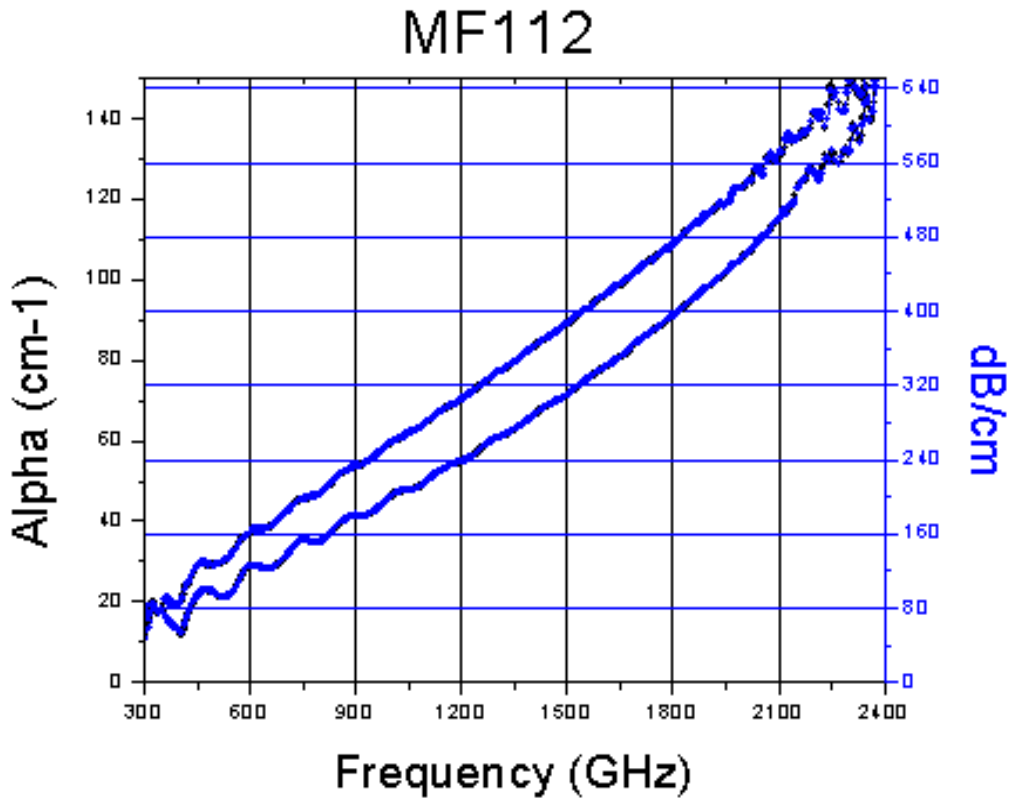

Figure 2 Upper trace 300 K, lower trace 5 K

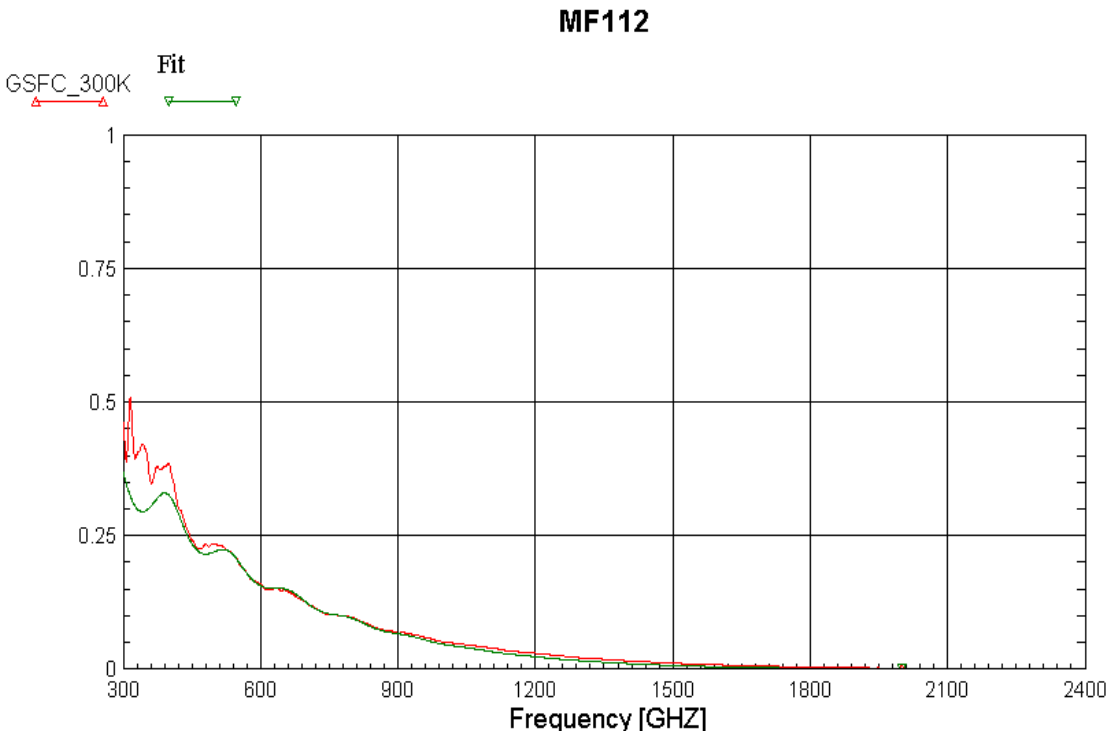

Figure 3 MMICAD fit to 300 K transmittance data.

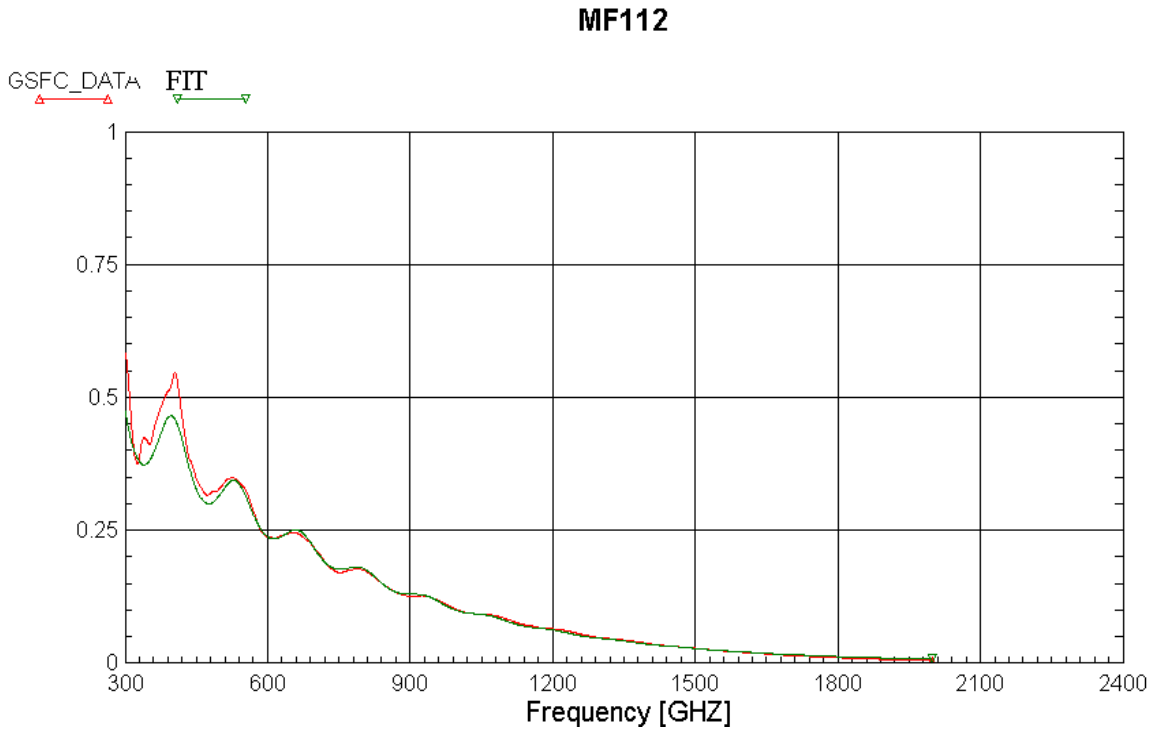

Figure 4 MMICAD fit to 5 K transmittance data