The Genzel interferometer

Another innovative concept for far-infrared spectroscopy is being used by Bruker in their in their IFS113v spectrometer which incorporates a Genzel interferometer. The design of this instrument is shown in Figure 1. Unlike a standard Michelson interferometer where the light is collimated at the beamsplitter and is never focused until it emerges, in the Genzel interferometer the light is focused onto the beamsplitter. The beams that are transmitted and reflected by the beamsplitter pass to two collimating mirrors and hence to a double-sided moving mirror. As the mirror moves, the path in one arm increases and the path in the other arm decreases. The small size of the beamsplitter in the Genzel interferometer allows several beamsplitters to be mounted on a wheel and interchanged without breaking the vacuum. The reduction in size significantly reduces the amplitude of the drum-head vibrations commonly associated with large-diameter Mylar® beamsplitters. Another feature of the Genzel interferometer is that the angle of incidence at the beamsplitter (s15°) is much smaller than a standard Michelson interferometer. This has the advantage of reducing the difference between the s and p polarizations (as shown in Figure 2), allowing optical polarization studies without having to reorient the sample. For a displacement, x, of the moving mirror, an optical path difference of 4x is generated by the Genzel interferometer. Although this has been claimed as an advantage for the Genzel over the Michelson interferometer, any tilt introduced on moving the mirror leads to a doubling of the error in comparison to the error introduced in a standard Michelson interferometer with the same tilt. Thus we do not consider this to be a major advantage. Nonetheless, the Genzel interferometer does have several significant advantages for far-infrared spectroscopy.

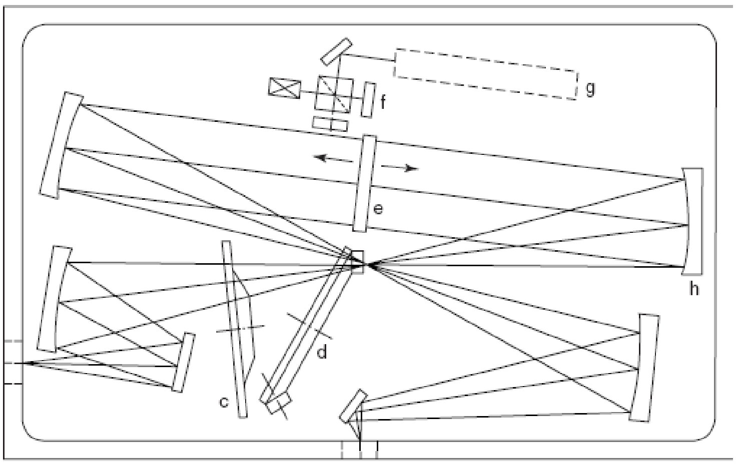

Figure 1 Genzel interferometer of the type incorporated in the Bruker IFS-113 FT-IR spectrometers: c, filter wheel; d, carousel on which up to six beamsplitters may be mounted; e, moving two-sided mirror; f, reference interferometer; g, He–Ne laser; h, spherical collimating mirror.

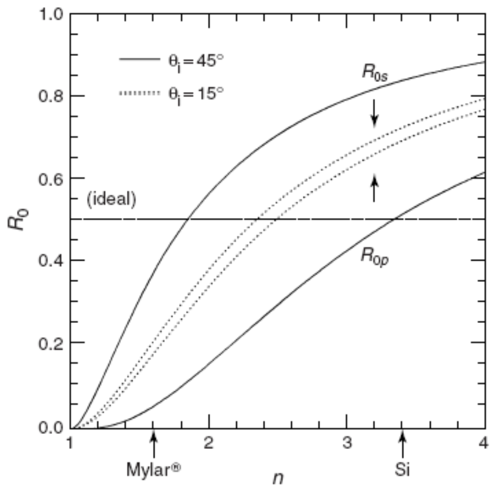

Figure 2 Variation of R_0 for s- and p-polarized radiation as a function of the refractive index of the material from which the beamsplitter is fabricated at 45° and 15° incidence. Note the much smaller difference between the values of R_{0s} and R_{0p} at an incidence angle of 15° compared to 45°.

Copied from "*Instrumentation for Far-infrared Spectroscopy*" Peter R. Griffiths and Christopher Homes