

The Bruker ROCKSOLID[™] Interferometer

TECHNICAL *note*

Bruker entered the field of FTIR Spectroscopy in 1974, setting the standards in research FTIR with evacuable optics, high spectral resolution, and automatic range change. Today Bruker manufactures the widest range of FT-IR spectrometers, offering instruments ranging from routine use to advanced high resolution spectrometers with 0.001 cm⁻¹ spectral resolution. Bruker has led the development of many of today's most important FTIR innovations and prides itself not only on a high level of customer support but also on technical innovation. Perhaps nowhere is this innovative spirit more apparent than in the design of the Bruker ROCKSOLID interferometer.

The interferometer is the heart of a FTIR and is one of the main reasons for the superior performance of Bruker spectrometers. The simplest form of an interferometer is the Michelson type, with flat mirrors, as shown in figure 1. With the exception of refractively scanned interferometers all interferometers operate on these principals, although variations are found in various FTIR models. The light from the infrared source travels to a beamsplitter that is ideally 50% reflective. Therefore 50% of the light is directed to a stationary mirror and 50% travels to the moving mirror. The light returning from both mirrors is recombined at the beam splitter. As the moving mirror travels back and forth various wavelengths of light go in and out of phase. By recording the signal observed by the detector at regular, precise intervals, the raw data for the interferogram is generated. This is then Fourier transformed into the desired spectrum.



Cube corner interferometers are in wide use for laboratory and process applications and have some unique characteristics. Unlike flat mirrors, cube corners are practically immune to mirror tilt (i.e. angular movement of the mirror). This is an important consideration since the light returning to the beam splitter must be precisely recombined or a reduction in the stability, resolution, and spectral quality will occur.



(top) vs. retroreflecting cube

Figure 2

One approach to address this problem in interferometers with flat mirrors is to use a technique called dynamic alignment. In a dynamically aligned interferometer, either the moving or fixed mirror is equipped with piezo transducers which tilts one mirror after a positional error is detected on the other. The disadvantage of this technique is that the error must first occur and then be detected before the correction can be made. Another disadvantage is that current commercial FTIRs with a dynamically aligned interferometer, use of either an air bearing which is expensive, or a mechanical bearings which is prone to wear. Note that even if a design specifies a drive system that is referred to as a frictionless electromagnetic drive (i.e. voice coil), the bearing itself may in fact be a contact mechanical type prone to wear.

The ROCKSOLID interferometer incorporates dual retroreflecting cube corner mirrors in an inverted double pendulum arrangement. A wear-free pivot mechanism is located at the center of mass. This patented design optically eliminates mirror tilt and mechanically prevents mirror shear. It is also resistant to vibration and thermal effects. The wearfree nature of the bearing in the ROCKSOLID interferometer ensures exceptional stability and reliability even in harsh environments. The high throughput design deliveries the highest possible signal-to-noise ratio, resulting in the fastest and most accurate results possible.



United States Patent Number 5,309,217 ROCKSOLID layout: 1.Beam Splitter, 2. Cube Corner Retroreflectors, 3. Wearfree pivot mechanism



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