Test of Our New Transmittance and Reflectance Probes in Conjunction with the Bruker 113 Spectrometer in SCM 3

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Introduction

A superconducting magnet (SCM3) has been modified for ultra fast optics facilities and use with our infrared (IR) spectrometer.

Experimental

We have built two general-purpose probes for SCM3, one reflectance and one transmittance. The reflectance probe can hold three samples and the transmittance probe can hold four samples at the same time. In order to reach best possible signal to noise ratio, we have used largest possible and high conductive brass light pipes for these two probes. The reflectance probe mainly consists of two ¾” brass tubes and a V-shaped (about 20 degree) reflector at the bottom, and the transmission probe consists of a 1” brass tube in conjunction with a light cone. Both probes use Si-bolometer as the detector, which covers entire IR region. Due to the large diameter of light pipe on the probe as well as radiation from both top and bottom of the magnet (since SCM3 has a unique tube from the top of the dewar to the bottom, through the bore of the magnet with gate valves on both ends to provide experimental access), we have to make extra effort to cool the detector. A number of brass buffers on the top and a brass cavity at the bottom have been used to shield the room temperature radiation and after a few test runs the bolometer has been cooled down to liquid helium temperature.

Results and Discussion

The test results from both the transmission and the reflection probes have been very positive. Even at this early stage of development the signal to noise ratio is no worse than that of SCM2. The signal level from both SCM3 probes is higher than that from the equivalent probes from SCM2, thanks to the larger diameter of the brass tubes used for SCM3 probes. The noise level has been cut down greatly after a few test periods, and here we are taking the advantage of the fact that the Bruker 113 spectrometer does not have to move between measurements as in SCM2. By the end of last year, the signal to noise ratio for SCM3 reflectance probe has been better than its counter part for SCM2 and the signal to noise ratio for SCM3 transmittance probe is comparable to its counter part for SCM2. Both of these probes are now ready for the external users.

Conclusions

Both transmission and reflection probes for SCM3 are now ready for the users, and their signal to noise ratio has been comparable to their counter parts for SCM2. We are confident that with further work the unique nature of this user facility will be fully realized.