SURFACE BRILLOUIN SCATTERING FROM GRAPHITE*

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This letter discusses the conflicting results of two previous Brillouin scattering determinations of the C_{44} elastic modulus of graphite.^{1,2} As such we will not repeat the introductory reasons for performing the experiments or their implications.

In reference 1 it was found that the velocity of surface waves on the basal plane of a single crystal of natural graphite was $1.50 \pm .05$ km/s leading to $C_{44} = 5.05 \pm 0.35$ GPa. In Ref. 2 the velocity on HOPG graphite was found to be 1.20 ± 0.02 km/s yielding $C_{44} = 3.25 \pm .015$ GPa. Although the effects of finite collection angle had been discussed in Ref. 1 it was concluded in Ref. 2 that an error had been made in accounting for the solid angle.

We have now remeasured our graphite sample and obtained identical results to those we presented earlier i.e. 1.52 ± 0.03 km/s. We have also measured a sample of HOPG graphite and obtained 1.20 ± 0.05 km/s in good agreement with the results of Ref. 2.

The remaining question is to decide which value is more representative of 'ideal' graphite. Our samples consist of crystallites which can be estimated to be close to 0.5 mm in diameter so that the ~0.1 mm laser spot only probes one crystal, HOPG graphite is usually made up of crystallites of ~1 mm in size and which are only aligned to within 1 - 5 degrees along the c axis. Since the phonon wavelengths are only a few times smaller than the

crystallite size one could expect the boundaries between crystallites to play a significant role in determining the velocity of wave propagation. We interpret the results of the previous paragraph as a confirmation of this fact.

The graphite samples used in our experiments have been shown to possess excellent surface quality as probed by atom scattering.³ Furthermore our x-ray scattering characterization showed that the coherency perpendicular to the layers is greater than 2000Å (close to the resolution of the instrument). Since there appears to be no reason to distrust our measurements we feel that the higher values of the velocity and of the elastic constant measured on the natural sample represent the 'real' value for graphite.

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