Abstract No. frie27

**Plasmons in MgB2**

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Beamline(s): X21

**Introduction**: A most remarkable discovery in the last year is the superconductivity at 40K of $MgB_2$ [1]. Due to an apparent anomalously small effective coulomb interaction $\mu^*$, Voelker [2] and collaborators have suggested a novel charge response from $MgB_2$ in the form of acoustic plasmons. This has motivated at least two detailed calculations of plasmons in $MgB_2$ [3,4]. Although these calculations find no indication of acoustic plasmons, there is a very interesting calculated charge response in the form of a very broad plasmon at ~20eV and an extremely sharp collective excitation with energy between 2-5 eV. The purpose of our study is to measure the low energy collective charge excitations and to compare our measurements with the previously mentioned calculations.

**Methods and Materials**: We measured the inelastic scattering from $MgB_2$ powder and from oriented thin films. $MgB_2$ films were prepared on (0001) oriented $Al_2O_3$ single crystal substrates by pulsed laser deposition at 800°C for 60 minutes followed by post annealing in Mg vapor at about 900°C for 60 minutes as described in ref. [5]. Resistance measurements of the deposited $MgB_2$ films show $T_c$ of 39K while a scanning electron microscopy and X-ray diffraction analysis indicated that the film consisted of well-crystallized hexagonal grains with a highly c-axis-oriented structure. The full width at half maximum of the (002) $MgB_2$ rocking curves were 1-2 degrees wide.

**Results**: The inelastic scattering from the oriented thin film was too weak to be measured, most likely indicating that the film was not sufficiently thick. The conventional plasmons near 20eV (Fig. 1) were measured in the powder sample for several values of q. We found no evidence of the calculated sharp lower energy excitation, possibly due to the low weight, insufficient resolution or directional averaging of the powder.

**Conclusions**: A portion of the plasmon dispersion was measured in powdered $MgB_2$ using inelastic X-ray scattering. Higher resolution studies on thicker oriented films, or single crystals are planned.

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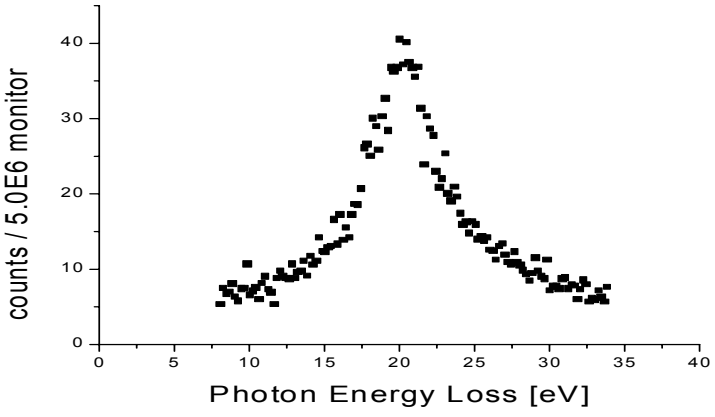


**Figure 1**. Plasmon in MgB2 powder at q=0.4 q [1/ang].