Inelastic X-ray Scattering in Pure Nickel

C. Burns, (Western Michigan U.)

Abstract No. Burn8375
Beamline(s): **X21**

Introduction: We have begun studies of the electronic excitations in the transition metals nickel as a function of energy and momentum transfer. One goal of these studies is a better understanding of the interaction of the plasmon with the d-bands. Understanding the role of band structure on the plasmon properties is important for testing models of the electron gas (which often ignore band structure). Also, a better understanding of the electronic excitations in the transition metals will improve our knowledge of these systems and their compounds.

Results: We have carried out preliminary measurements of the electronic excitations in a sample of high purity (99.999% pure) polycrystalline Ni at beamline X21. The data are shown in Figure 1. Non-resonant inelastic x-ray scattering measurements were taken using a spherically bent, diced, germanium (6 4 2) analyzer in a near backscattering geometry. The analyzer was tuned to 8208 eV, and a Lorentzian fit to the elastic peak yielded an energy resolution for the system of about 0.6 eV.

Measurements were taken by scanning the incident energy and leaving the analyzer energy fixed. We had a signal of about one count per five seconds. All data have been normalized to the incident flux. Each momentum transfer took about 36 hours to acquire. The data at a typical momentum transfer of 0.76Å^{-1} is shown in figure 1. The plasmon is generally taken to be the broad peak centered at 25 eV. The width of the peak, and the structure in it are clear indications of the interaction with the metallic bands.

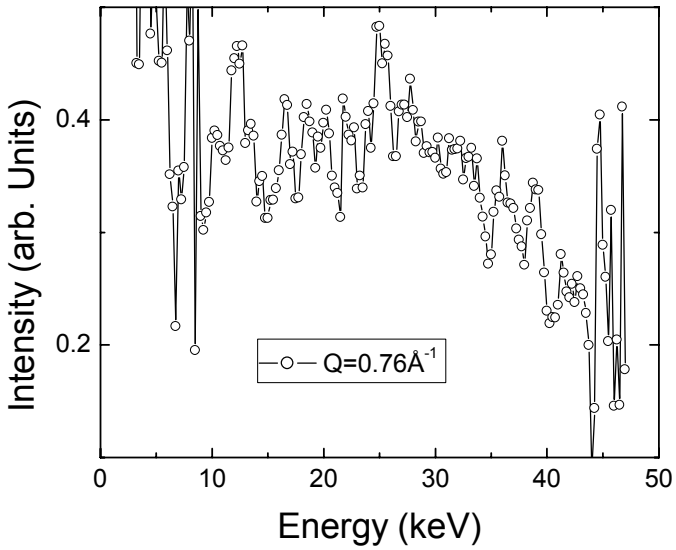

Figure 1.Inelastic Scattering in Polycrystalline Ni at a momentum transfer of 0.76Å^{-1}.

Conclusions: These results show the feasibility of studying the electronic excitations in the transition metals using inelastic x-ray scattering at the NSLS. Further measurements of the momentum dependence of the excitation will help clarify the interaction between the band structure and the plasmon.

Acknowledgments: We would like to acknowledge the assistance of C.-C. Kao and W. Caliebe on the beamline.