

An Angle-Resolved Photoemission Extended Fine Structure Study of Ni Valence Band and the 6-eV satellite

X. Zhou^{1,2}, E.J. Moler¹, Z. Hussain¹ and D.A. Shirley¹

¹Advanced Light Source, Ernest Orlando Lawrence Berkeley National Laboratory,
University of California, Berkeley, California 94720, USA

²Department of Physics, Pennsylvania State University, University Park, Pennsylvania 16802, USA

INTRODUCTION

Angle-Resolved Photoemission Extended Fine Structure^{1,2} (ARPEFS) has been successfully applied to various adsorbate systems to study their surface structures and obtain very precise geometrical parameters. Recently this experimental technique has also been applied to clean metals³ and various satellite structures⁴ in core-electron photoemission. When we carefully look at the behavior of the spectra in a wide photon energy range (100eV – 800eV), and the behavior of their Fourier Transforms, a lot can be learned about the origin of the satellites. A Ni(111) single crystal is studied in this experiment as Ni is a strongly correlated system with narrow bands and interesting satellite structures. The experimental setup⁵ and the data reduction process are described in detail elsewhere.

RESULTS AND DISCUSSION

The most striking feature in the ARPEFS (Fig.1) is that the satellite photoemission intensity oscillates much more than the main peak intensity, which implies that the satellite is much more localized than the main peak. People have attributed the 6-eV satellite to a two-hole bound state, $3d^84s^2$ in atomic notation, and the valence band main peak to $3d^94s$, with strongest evidence so far coming from resonance photoemission experiments⁶. Our study supports this assignment in a totally new way. More analysis is underway for modeling the ARPEFS curves with multiple-scattering calculations based on Rehr-Albers separable propagator.

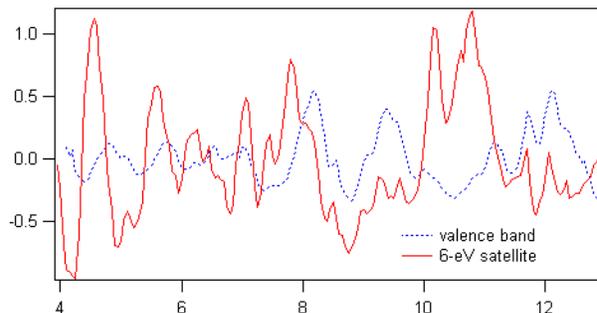


Figure 1. Ni(111) normal emission ARPEFS. The x-axis is the photoelectron wavevector in \AA^{-1} .

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Principal investigator: David A. Shirley, Advanced Light Source, Ernest Orlando Lawrence Berkeley National Laboratory. Email: dshirley@lbl.gov. Telephone: 510-486-5926.