Final Technical Report

ROTATING ANODE X-RAY SOURCE
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I. Introduction

This instrumentation grant was for the purchase of a Rigaku 18kW rotating anode x-ray source, a Huber Eulerian cradle, and ancillary components to go with these two items. The grant is to complement our DOE-funded research program, the goal of which is to study the origins of magnetic anisotropy. The x-ray diffraction equipment in this grant contributes to this effort through greatly improved sample characterization.

II. Summary of the impact of the equipment on our DOE-funded research

The Rigaku 18kW rotating anode x-ray source and the Huber Eulerian cradle have been installed in our laboratory and operate according to their specifications. The equipment has contributed significantly to our ability to characterize samples, and has benefited our DOE-funded research program. The rotating anode source has been incorporated into two diffractometers, a low-angle $\Theta-2\Theta$ unit for thin film and x-ray mirror characterization, and a high angle Seeman-Bohlin unit for crystal phase analysis in polycrystalline thin films and powders. In addition, the Huber Eulerian cradle has upgraded the existing $\Theta-2\Theta$ goniometer to a full four-circle goniometer that, coupled with the higher x-ray intensity from the rotating anode, significantly broadens the range of x-ray diffraction techniques (including specular and non-specular scattering) available to us. These two diffractometers were previously operated with a standard laboratory sealed tube, therefore the rotating anode source has increased the x-ray intensity available to us for these measurements approximately 50-fold. For the low-angle measurements, the higher intensity reduces the acquisition time of a typical scan to ~1-2 hours from 24 hours or more, such that all or most samples in a multilayer series can be studied, rather than just a few representative samples. This allows the dependence of structural properties on growth parameters to be more effectively characterized. Also, the resulting

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greater dynamic range allows data to be taken out to higher angles before the noise level is reached, which in turn allows for more definitive structure determinations. For the Seeman-Bohlin measurements, the greater intensity allows analysis of smaller crystals and thinner films.