

X6 EXPERIMENT

X-RAY POWDER DIFFRACTION

(revised November 2005, L.N. Hand)

Introduction

This experiment is an excellent introduction to crystallography, x-rays and to x-ray diffraction. For starters, read Chapter 1 of Jenkins and Snyder, *Introduction to X-ray Powder Diffractometry*, and Chapter 2 of Kittel's *Introduction to Solid State Physics* (Third Edition).

Get the lecture and the written material on radiation safety from your instructor. Learn how to use the radiation monitor. You both should then sign and date the certificate signifying that you have read and understood the safety material.

Either the instructor or Nick will show you how to operate the x-ray generator and give you darkroom and film handling instruction. The x-ray unit has a copper target, and uses 35 KV and 15 ma. There is a nickel filter, which must be in place when you make the exposures. Learn about copper K_{α} and K_{β} radiation.

Photograph the powder patterns of NaCl and KCl first. Do this, and analyze the patterns before proceeding. Show the results to your instructor and look at the sample results for NaCl in these notes. A typical exposure is 3 hours (use the timer). There may be residual K_{β} lines, so take another picture without the Ni filter for about half the exposure time. When you have identified all the lines on the KCl and NaCl films, you will have understood the difference between simple cubic, body-centered, and face centered cubic lattices.

Next, photograph the lines from one or more of the unknowns. Be sure to record the number of the unknown, so that later you can see if your identification is correct.

Do not forget to make a record in the logbook every time you make an exposure. This, and the signed safety certificate, is a legal requirement by the University.