

Hard Disk Surface Composition Maps with the *Quantera II* Scanning XPS Microprobe

Introduction

As the density of stored data increases on hard disks, the read/write head must fly closer to the disks surface. This is driving the use of thinner lubricant layers and lubricants with new compositions. XPS measurements are the established method for characterizing these ultra thin (< 30 Å) lubricating layers. The *Quantera II* SXM provides the surface sensitivity, sample handling flexibility, and software tools needed to efficiently characterize lubricant films on hard disks.

Quantitative Hard Disk Surface Composition

To demonstrate this capability a 95 mm hard disk was removed from a production line and inserted in to a *Quantera II* SXM. 150 analysis points were defined by the instrument control software package and spectra were collected for F, C, and O at each location automatically.

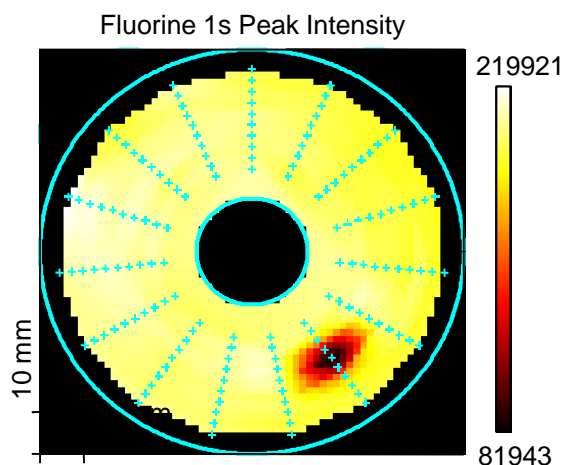


Figure 1: XPS raw peak intensity map for fluorine, showing the 150 analysis points and a region on the hard disk where the lubricant is missing.

Using PHI's *MultiPak* data reduction software elemental intensity maps can be created as shown for fluorine in figure 1. Quantitative map displays can also be created with *MultiPak* as shown in figure 2. The maps show that there is a small area on the disk surface that was not coated with the fluorocarbon lubricant. The remainder of the disk is uniformly coated as expected.

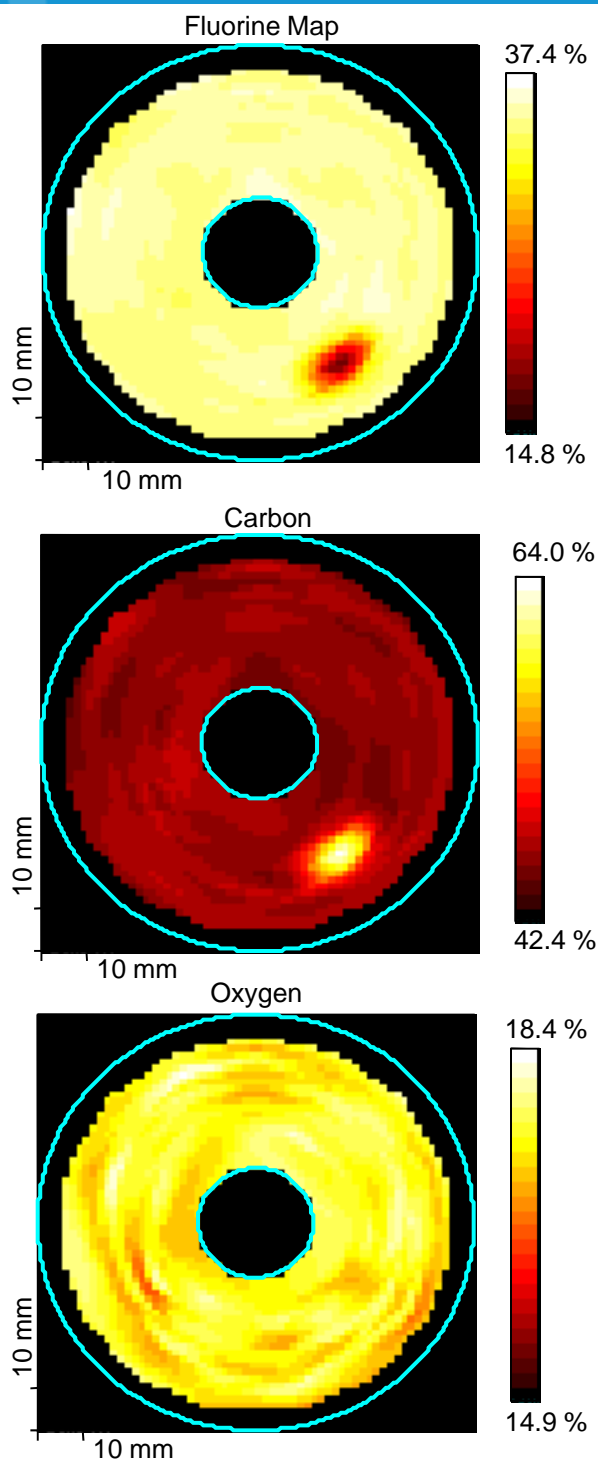
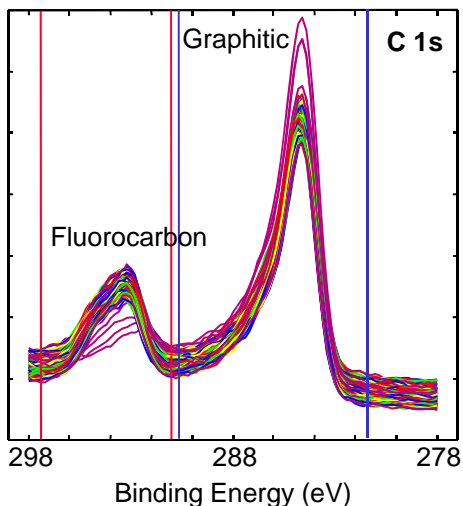


Figure 2: Quantitative surface composition maps for fluorine, carbon, and oxygen on a lubricated hard disk surface.

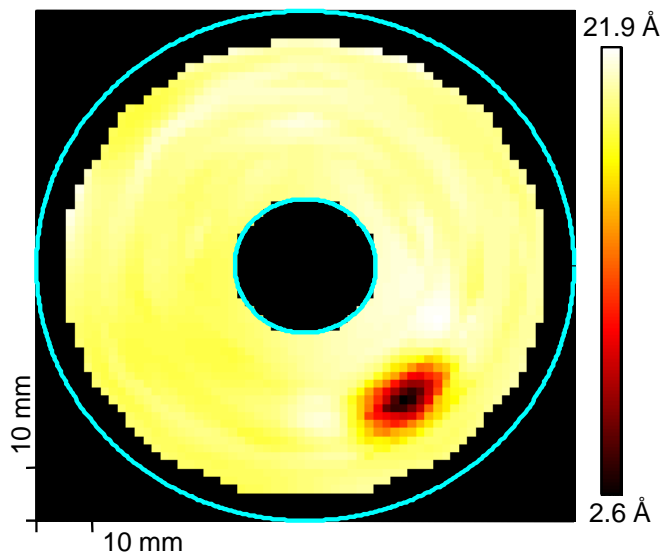
Film Thickness Measurements

In addition to providing surface composition information the *Quantera II* can provide information about the thickness of ultra thin surface layers. Based on the ratio of fluorocarbon and graphitic (DLC) carbon peak intensities, the thickness of the lubricant layer can be calculated with *PHI MultiPak*.



The ratio of the fluorocarbon and graphitic (DLC) carbon peaks can be used to determine the thickness of the lubricant on the hard disk.

Lubricant Thickness Map

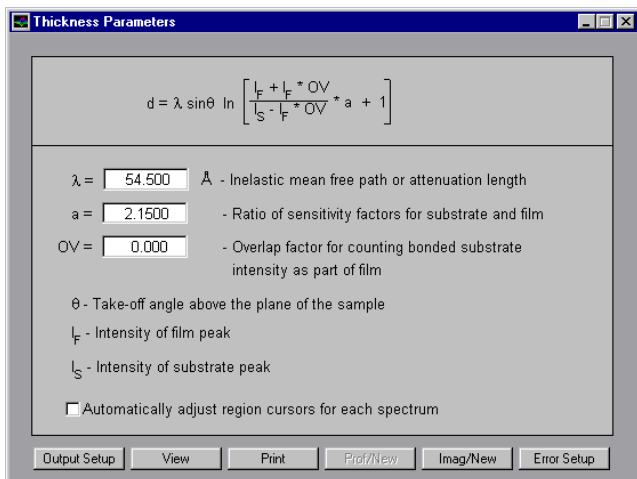


Lubricant thickness map showing an island on the disk where the lubricant is missing.

Summary

The *Quantera II* provides high sensitivity for the detection of thin lubricating layers on hard disks. Software tools in *PHI MultiPak* provide the ability to generate two dimensional quantitative compositional maps and lubricant thickness maps of hard disks.

1. C.S. Fadley, Progress in Surface Science, V 16, 1984



The "Thickness" tool in *PHI MultiPak* uses a standard single overlayer model¹ for determining the thickness of an ultra thin film.