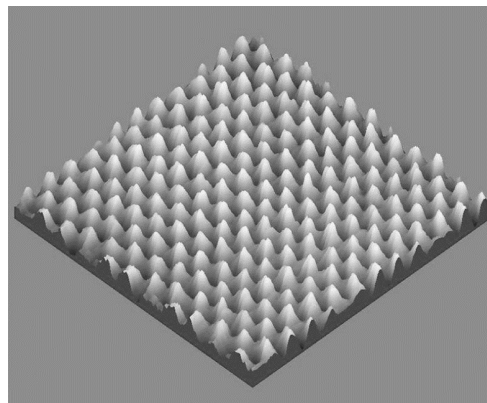


Highly Orientated Pyrolytic Graphite

AGG3389

Introduction

HOPG is a form of high purity carbon which provides surface microscopists with a renewable and smooth surface. Unlike mica, HOPG is completely non-polar and, for samples where elemental analysis will also be done, it provides a background with only carbon in the elemental signature. The extreme smoothness of HOPG makes results in a featureless background, except of course, at atomic levels of resolution.



Basal Plane Image

In an atomic resolution scanning tunnelling microscope image of the graphite structure of HOPG, there are two possible images. The image normally obtained looks like a close packed array; in this array, each atom is surrounded by six nearest neighbours. The distance between any two of these atoms is 0.246nm. Under ideal conditions, particularly if the probe tip is truly a single atom, you will see the "chicken wire" structure that shows the hexagonal rings that are the true structure of graphite; the centre to centre atomic distance in this image is 0.1415nm. This distance, in either case, is an atomic property of carbon, and it does not depend on the grade of graphite. The image shown here is the close packed array, and that is the image obtained from the basal plane of HOPG under most circumstances.

Columnar Structure

The structure is strictly columnar, that is, the columns run vertically within the flat slab of the material. In other words, the grain boundaries can be seen on the lateral surfaces. And saying it then another way, the Mosaic Spread is the angle of deviation of the grain's boundary from this perpendicular axis (of the columnar structure). Researchers in laser physics seemed to find this aspect of the information important, so that is why it is presented.

Some interesting information about HOPG:

Cleaving Properties

HOPG, because of its layered structure, cleaves almost like mica. The usual approach is to take a piece of tape (e.g. 3M® "Scotch Brand" double sided tape), press it onto the flat surface and then pull it off, and the tape invariably takes with it a thin layer of HOPG. This freshly cleaved surface is what is used as sample substrate material.

Mosaic Spread

This term is a measure of just how highly ordered is the HOPG. The lower the mosaic spread, the more highly ordered is the HOPG, resulting in a cleaved surface that exhibits virtually no steps. Lower mosaic spreads are also associated with higher prices.