ORGANIC THIN FILMS

Introduction

Due to their exciting structural, electronic, and optical properties thin crystalline films of organic molecules on inorganic substrates have attracted considerable attention. These hybrid structures are also promising for new applications, e.g., in coating technology, optoelectronics, sensors, and bio-medical devices. One of the characteristics of organic materials is the possibility of a modular approach which permits the tailoring of certain desired properties by attaching the appropriate functional groups. As an example we show an X-ray study of the organic semiconductor copper hexadecafluorophthalocyanine [Fig. 1].

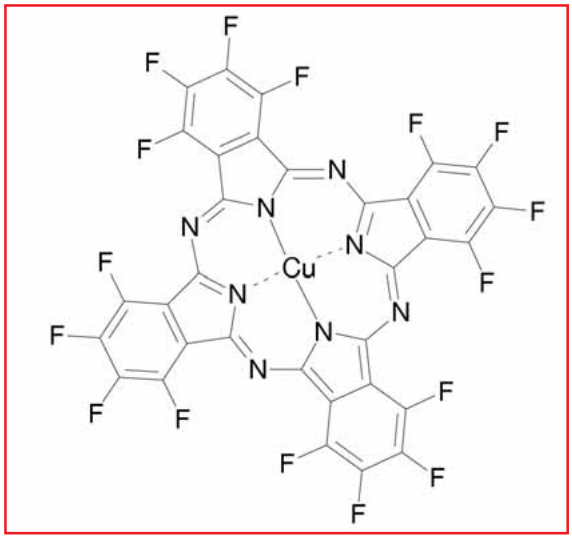

Figure 1: Chemical model of copper hexadeca-fluorophthalocyanine

The structural film properties of $C_{32}F_{16}N_8Cu$ grown by Organic Molecular Beam Deposition under UHV condition are investigated, by means of X-ray reflectivity and diffraction.

Results

Figure. 2 shows a typical reflectivity scan with well-defined Kiessig interference fringes and the first order Bragg reflection (2-theta = 5.88° which corresponds to the out-of plane lattice parameter of 1.5 nm) with accompanying Laue oscillations. From the separation between Kiessig fringes we can calculate the total film thickness (11.17 nm).

The presence of finite thickness oscillations close to the Bragg peak determines the number of crystalline planes of the film, which scatter coherently and the crystalline thickness of the film (10.2 nm).

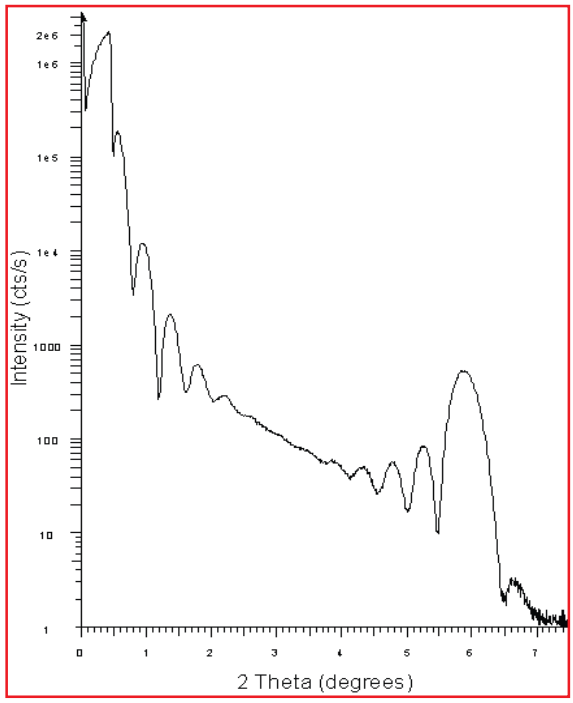

Figure 2: Reflectivity and first order Bragg reflection curve of organic film on SiO_2

From the two dimensional diffuse scattering map, we can obtain information about the lateral perfection (roughness) of the film. The narrow streak coming from the reflectivity rod of scattering corresponds to a very flat and uniform film. The clearly defined Bragg reflection is a measure of the small crystalline mosaic spread.

Figure 3: D8 DISCOVER with reflectometry sample stage

Instrumentation [Fig. 3]

D8 DISCOVER

- Tube: Cu Long Fine Focus
- Sample Stage: Reflectometry Stage
- Detector: NaI scintillation counter
- Generator: 40KV, 40mA

Optical set-up

- Primary: 40 mm Göbel Mirror, motorized 4-position absorber and 0.12° Soller Slits
- Knife edge collimator at the sample position (optional)
- Secondary: automatic slits

Authors:
O. Osso, F. Schreiber, Max-Planck für Metallforschung, 70569 Stuttgart, Germany
A. Vigliante, Bruker AXS, 76187 Karlsruhe, Germany

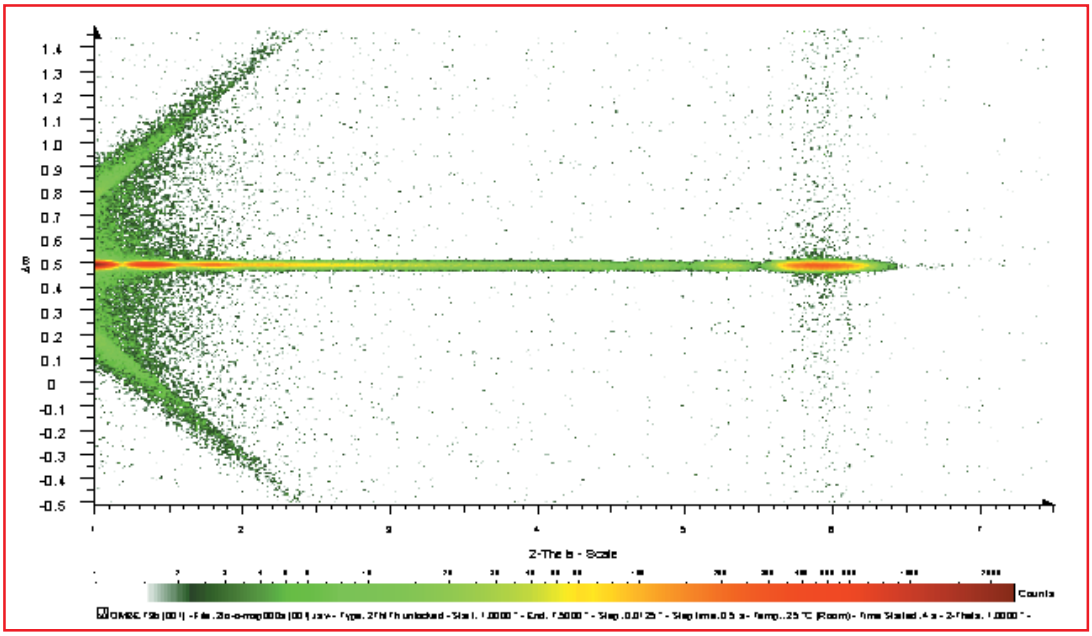

Figure 4: Reflectivity diffuse scattering map close to the 000 reflection.

BRUKER AXS GMBH
OESTLICHE RHEINBRUECKENSTR. 49
D-76187 KARLSRUHE
GERMANY
TEL. (+49) (721) 595-2888
FAX (+49) (721) 595-4587
EMAIL info@bruker-axs.de
www.bruker-axs.de

BRUKER AXS, INC.
5465 EAST CHERYL PARKWAY
MADISON, WI 53711-5373
USA
TEL. (+1) (800) 234-XRAY
TEL. (+1) (608) 276-3000
FAX (+1) (608) 276-3006
EMAIL info@bruker-axs.com
www.bruker-axs.com