Homeotropic alignment of columnar molecules in open films in view of their use in photovoltaic devices

Beamline: X6B

Category of Researcher:
Contributing User

Technique:
X-ray diffraction

Researchers & Affiliations:
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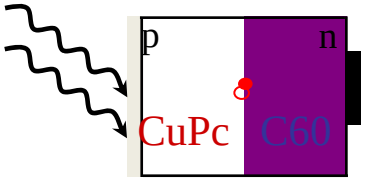
R. Gearba, D.V. Anokhin, D.A.Ivanov, C.T. Black, R. Pindak, Homeotropic alignment of columnar materials under confinement for use in organic solar cells, Materials Research Society Meeting- poster presentation, Boston 25-30th November, 2007.

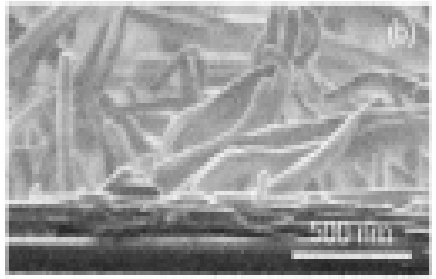
Motivation:

Organic solar cells: high efficiency demonstrated

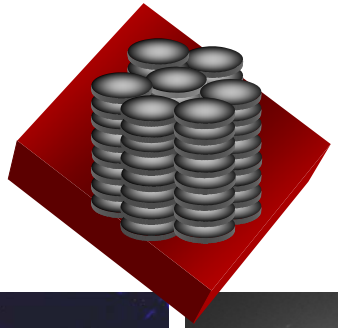
Forrest et al. (Appl. Phys. Lett. 85, 5758, 2004) $\eta_P = 5.7$ %

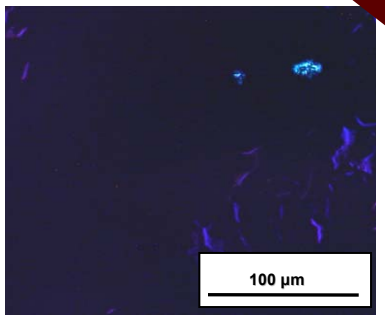


CuPc at the electrodes



poor organization





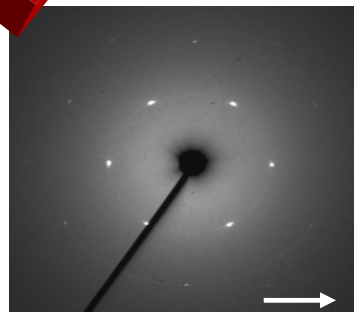


Figure 1. Schematic representation of homeotropic Alignment of columns (Top). POM (left) and X-ray diffraction (right) data showing a homeotropic alignment of a phthalocyanine derivative

Results:

Method: homeotropic alignment can be obtained in open films by patterning the surface

Our results support the following strategies to achieve homeotropic alignment in thin open films:

- **Increase the core size of the molecules**
- **Avoid bulky linking groups such as sulphur**
- **The existence of a Col_{rd} is detrimental, whereas the Cr phases are not**
- **The presence of an isotropic phase at high temperatures is not necessary, a large window of existence of a Col_{hd} phase being enough.**