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# PHASE-CONTROLLED PENTACENE THIN FILMS AND THEIR CHARACTERISTICS IN ORGANIC TRANSISTORS

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Pentacene is an organic molecule consisting of five fused aromatic rings and there are at least four known crystalline phases in pentacene thin films.

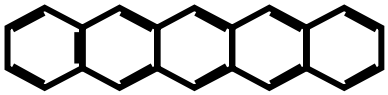

Fig.1 structure of the five fused aromatic rings of pentacene

By variation of different parameters such as substrate temperature and by choosing the right substrate the portion of each phase can be controlled in a defined manner.
One of the two main phases, the so called thin film phase is of high importance in thin-film transistors, because of its high mobility, which is similar to those in amorphous silicon TFTs. The second main phase is the bulk phase and there are strong indications that the intrinsic mobility is much lower compared to the thin film phase.
In the present work we grow and analyse polycrystalline pentacene films on different substrate materials.

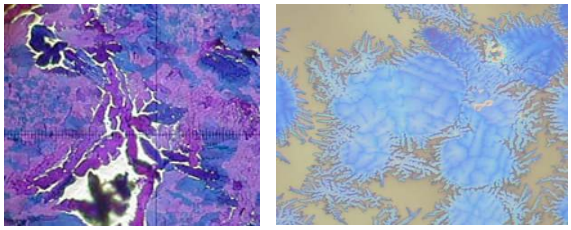

Fig.2 Examples of Pentacene thinfilms on glas (treated with an acid) and on $SiO_2$ in the optical microscope

These films were treated either by immersion in an organic liquid or by temperature treatment to cause phase conversion between the thin film- and the bulk phase of pentacene. The films were analysed with optical microscopy, Atomic Force Microscopy (AFM) and by x-ray diffraction.

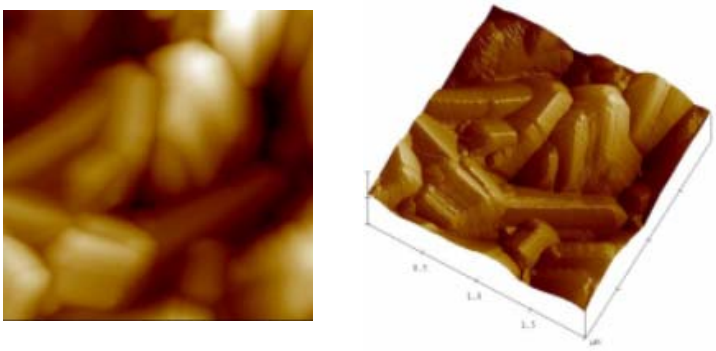

Fig.3 A Pentacene thinfilm in the AFM (Sample surface image and three dimensional construction)

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Based on these techniques we could observe the change of the morphology of the polycrystalline films with respect to their ratio between the phases. The characteristics of pentacene based thin film transistors were measured in dependence on the different phases.

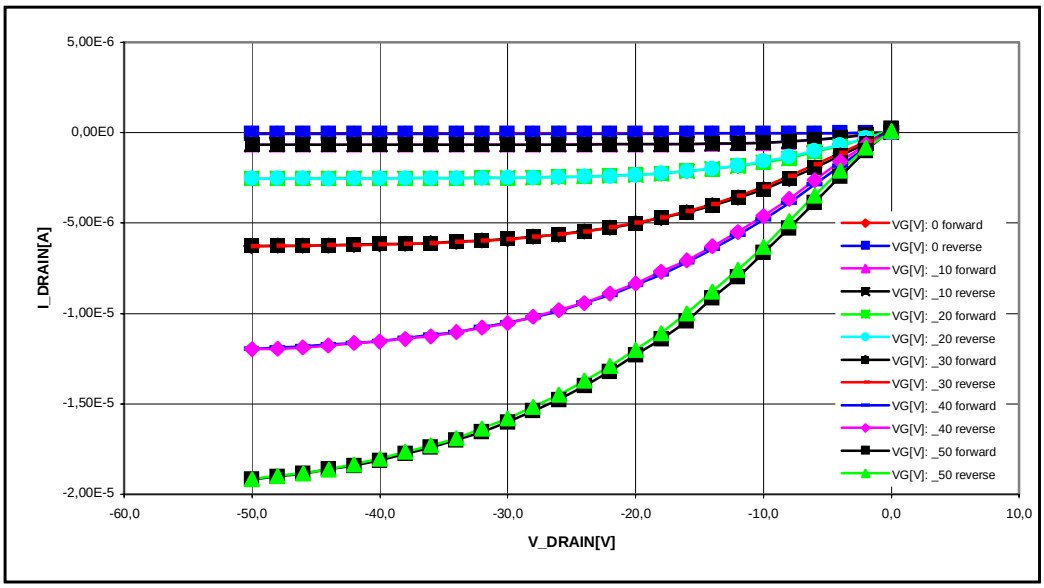


Fig. 4 Output characteristics of a PVP-TFT 50nm pentacene on PVP crosslinked, untreated

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