Nanostructured surfaces

Structure and optical properties of pentacene nanofilms obtained on glass/ITO by thermal evaporation and laser ablation method

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Pentacene (Pn) is currently the most promising organic semiconductor due to high charge carrier mobility and could be applied in field effect transistors and as a sensor material. The electrical and optical properties of Pn layers depend strongly on the crystal structure sensitive to the method of deposition. We studied the structure, morphology and optical properties of Pn nanolayers grown by the thermal vacuum deposition (TVD) and pulsed laser deposition (PLD) method. The layers were obtained on the glass coated by indium-tin-oxide (glass/ITO), two laser fluences in the case PLD were used.

The influence of deposition process parameters on surface morphology and crystalline structure of Pn layers was investigated by electron microscopy, optical spectroscopy and reflection electron diffraction (RHEED). The Pn layer prepared by TVD method shown a homogeneous structure consisting of spherical grains with a diameter of up to 100 nm, however longitudal crystallites with size 300 nm x 50 nm are visible too. The RHEED pattern confirms the polycrystalline character of the layer. The diffraction pattern of PLD-coated layer deposited with fluence 0.75 J/cm^2 has a diffusion character, however, single diffraction spots are observed. SEM image of the Pn layer surface deposited with fluence 0.95 J/cm^2 reveals that it consists of grains with a diameter of 50-100 nanometers; however, there are also elongated crystals with a length of 1.1 microns and a width of 300 nm. The layer deposited with the higher fluence is composed with grains about 50-1000 nm, needle like crystallites with length 5-7 microns and width 2-4 microns are clearly visible. It found that layers obtained by the TVD have better optical properties compare to layers deposited by PLD method.