innovations

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TITLE: PROCESS FOR FABRICATING THIN FILMS AND THIN WIRE-LIKE STRUCTURES

INVENTOR: Randall Headrick

DESCRIPTION: The present invention includes a new process for fabricating thin films and thin wire-like structures, e.g., of organic semiconductor materials. Small molecules are dissolved in a solution and condense into a crystalline layer as the solvent evaporates. In one variation of the method, the solvent is allowed to evaporate without moving the substrate. In another variation, the sample is slowly withdrawn from the solution, or alternately the solution is pumped away very slowly. A high degree of control and a wide variation in structures is achieved by varying conditions such as the concentration, temperature, liquid level, and draw rate. Briefly, the effect occurs when the solvent evaporates and solution flows into the region of the meniscus in order to maintain the shape of the meniscus. Dissolved molecules are carried along, and concentrate in that region. As the liquid level is reduced, either by evaporation or by external control, the dissolved material condenses into a solid. The deposited film subsequently "seeds" growth at the new position of the meniscus, and the process continues, ultimately coating the entire wetted portion of the substrate with a uniform crystalline layer.

Growing crystalline structures of organic semiconductor materials have been the primary focus of the present invention because they are of significant current interest. Materials deposited include crystalline forms of anthracene, tetracene, and pentacene. However, it will be possible to deposit a wide variety of materials by the process of the present invention.

APPLICATIONS:

1)This is a low temperature process for depositing thin films on arbitrary substrates, including glass, silicon, and polymers. The substrate does not need to be crystalline.

2)This is a single-step process, which can be distinguished from "processing" methods such as laser recrystallization and laser annealing. It can also be distinguished from methods that depend on bonding thick layers, followed by a thinning step.

3)The method produces films with thicknesses less than several microns with extremely large crystalline grain sizes, exceeding 1 x 1 cm2

PATENT STATUS: Provisional Patent

LICENSING STATUS: World wide rights available

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