

High Throughput Method for Forming Organic Thin Crystalline Layers and Obtaining Multiple Stacked Thin Layers

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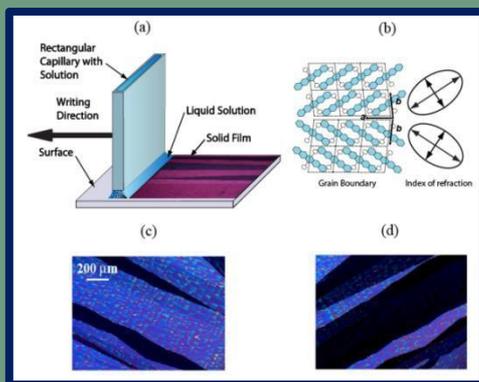
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Overview

Developing carbon-based “organic” compounds for microelectronic applications is a promising, rapidly evolving field of material science. Compared to traditional microelectronics, which are built from inorganic materials such as silicon and copper, organic microelectronics are flexible, lighter weight, less expensive and provide exciting new design possibilities for semiconductors, transistors, light emitters, smart windows and electronic paper.

To date, they have only been fabricated from unevenly crystallized or “disordered” materials because there has been no reliable, scalable method for producing well-ordered, layered, thin-film crystalline structures of these compounds.



Invention

In this process, small molecules are dissolved in a solution and condense into a crystalline layer on the surface of a substrate as the solvent evaporates. Dr. Headrick has developed a new variation of the method using a rectangular hollow pen to deposit films at speeds greater than 1 mm/s, and to deposit multiple stacked layers. The solution is held in the pen by surface tension, and is drawn out by capillary forces as the pen is moved over the surface. The film is deposited in a broad line on the substrate from the trailing edge of the meniscus.

A high degree of control of film thickness and crystalline grain size is achieved by varying conditions such as the concentration, temperature, and drawing speed. 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 concentrated in that region. As the meniscus is swept across the surface by external control, the deposited film subsequently “seeds” growth at the new position of the meniscus, and the process continues, ultimately coating the sample with a narrow line of arbitrary length consisting of a uniform crystalline layer.

Advantages

- Produces films with thicknesses less than several microns with extremely large crystalline grain sizes (exceeding one square centimeter)
- Single-step process eliminates need to bond layers and requires no thinning step

Applications

- Improves products currently using inorganic semiconductors by adding flexibility, reducing weight, boosting performance & speed, reduces production cost and purchase price
- Performance and production solutions to electronics, displays, solar cells, white lighting and room lighting markets

Patent Status

Patent Application Filed
Worldwide Rights Available

Learn more about Dr. Headrick’s research at:
<http://www.uvm.edu/~rheadric/>

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