ARTICLE ON ORGANIC SPINTRONICS PUBLISHED IN SENSOR TECHNOLOGY ALERT

****

Article Published on 02/22/2008

AN INNOVATIVE THIN FILM FABRICATION FROM ORGANIC SPINTRONICS' TECHNOLOGY

Spintronics is a technology that refers to spin-based electronics in which the information is stored and manipulated by the carrier's spin polarization rather than the charge. With the introduction of giant magnetoresistance (GMR) devices that can exhibit a large change in resistance in the presence of a magnetic field, spintronics had its origin since then. Magnetoresistive random access memory (MRAM) is an example of spin-based memory devices. Further developments of spintronics require the control of the spin polarization in a device. The challenges are associated with spin-based devices, which include spin injection and spin detection. The simplest spintronic device is a two terminal device such as the spin valve in which the receptivity depends on the applied magnetic field. The mainstream of research of spintronics is following the study of ordinary inorganic semiconductors such as gallium arsenide, but the main obstacle is the difficulty in reaching room temperature operation. The Bologna-based Organic Spintronics hold the international intellectual property (IP) for the use of organic semiconductors in spintronics achieving in this way the operation at room temperature. Organic semiconductors are more suitable for transport of spin polarization due to low- scattering rate compared to inorganic semiconductors.

Organic spintronics is a new area in the field of spintronics, wherein the devices are manufactured using organic semiconductors and half metallic ferromagnets (that is, colossal magnetoresistance [CMR] materials). The discovery of organic spintronics by the Bologna group is a major breakthrough in the field and may allow to make spintronics a reality in the real device world. Spin-based sensors provide benefits in terms of sensitivity, size, and power consumption, and can be used in such applications as memory elements, magnetic sensors, and logic elements such as spin field effect transistors (FETs).

Founded in 2003, Organic Spintronics is a spin-off company of the Italian National Research Council (CNR), Bologna Division. Organic Spintronics is not only focusing its research on spintronics, but also in development and commercialization of advanced nanomaterials; tools and systems for thin film deposition. Organic Spintronics also develops organic Knudsen cells that are suitable for thin film deposition of organic semiconductors, for use in plastic electronics and optoelectronics.

As a part of their developmental initiatives in the field of organic spintronics, the company has developed a pulsed plasma deposition (PPD) system for thin films deposition. In the semiconductor industry, more and more processes are adopted to produce thin films. Thin films are thin material layers, in which the thickness ranges between a few nanometers to hundreds of nanometers. Thin film technologies face technological constraints due to the complexity involved in engineering of thin films. The deposition of thin films using PPD is done by ablation of a target material using a fast pulse of electrons (100 ns) and the material is deposited on the substrate. Ablation by the fast electron beam causes the formation of a hot, dense, and high-velocity plasma. The salient features of the company's PPD system are a wide dynamic range of deposition rates (0.01 nm/s to 5 nm/s) and a wide range of operation vacuum conditions (10-2 mbar to 10-5 mbar) making it possible to reach the most diverse and suitable conditions of growth. The applications of PPD systems are metals, oxides and compound semiconductors; high dielectric constant thin films; buffer layers; hard coatings (diamond-like carbon [DLC], carbides, and nitrides), transparent conducting oxides (TCO); ultrahigh-temperature coatings; high-temperature superconductors; teflon; decorative coatings; biocompatible coatings, and single wall carbon nanotubes.

The unique characteristics of the PPD is the ability to transfer the chemical composition of the target to the film and in this way the most complex thin films may be fabricated. In addition, the temperatures needed to deposit thin films by the PPD are considerably lower than than that of the ordinary method making it possible to deposit on ordinary plastic substrates such as polyethylene terephthalate (PET). PPD when compared with pulsed laser deposition (PLD) offers enhanced benefits in terms of beam power density, repetition rate, and in particular in power efficiency. PPD system is very simple in construction and robust. It is characterized by low-power consumption and cost and therefore it is suitable to be scalable to large area systems. Following this concept, Organic Spintronics has developed a wide area deposition PPD system by using multiple guns for the fabrication of thin films on four inches substrates. The development of wider area roll to roll systems are under way under the stimulus of manufacturing industries. Organic Spintronics is also setting up thin film deposition processes on demand and posses a wide IP portfolio of PPD-based thin film fabrication processes.

Carlo Taliani, CEO of Organic Spintronics says that the company has pioneered the research and developmental activities in the field of organic spintronics. He also believes that the PPD may become a widespread industrial tool for the fabrication of thin films that have been previously only of academic interest.

Details: Carlo Taliani, CEO of Organic Spintronics, Via P. Gobetti 101, 40129 Bologna, Italy. Phone: +39-051-6398531. Fax: +39-051-6398539. E-mail: C.Taliani@bo.ismn.cnr.it. URL: www.organicspintronics.com.