Formation of thin graphitic layers from Diamond-Like Carbon obtained by Pulse Laser Deposition and assisted by thermocatalytic treatments.

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DLC or tetrahedral amorphous Carbon (ta :C) is a class of films materials which display properties not far from diamond. It is characterized by a large concentration of sp^3 carbon bonds, and it behaves as a semi-conductor with high hardness, chemical inertness and a large band of optical transparency. The synthesis of graphene or TGF (Thin graphitic films) on a high-quality insulator or semi-conductive substrate is a key to get a high-performance electronics. Thus, it has been reported that TGF film transferred onto DLC films used as substrate displayed the best electronic performances ever reported [1]. We have investigated the direct growth of Thin Graphitic Films on top surface of a Diamond-Like Carbon layer, obtained by pulse laser deposition on transparent quartz. To improve a surface graphitization, we have deposited a low amount (less than a monolayer) of transition metal catalyst like Fe or Co, on the initial DLC prepared previously. Finally, the sample is heated (500-1100°C) under a small H_2 pressure (10^{-5} mbar) in Ultra High Vacuum chamber. The different steps of the process are summarized in Figure 1. The surface conductivity measured by Hall effect increases by one order of magnitude with the treatment temperature, starting around 500°C (Figure 2). The small catalytic nanoparticles (10-30 nm) formed on the DLC surface enhance the carbon graphitization which is also promoted by the initial presence occurrence of an enriched sp^2-hybridized carbon layer on top of the DLC. XPS, Raman and UV-Visible spectroscopies underlines the presence of sp2-hybridized carbon on top of the DLC surface, the progressive formation of graphitic fragments and the formation of a conductive film through the collapse of the band gap. The motivation of this work is to find a new transparent conductive oxide (TCO) film with height performance characteristics, a low-cost manufacturing process and compatibility with organic solar cells.

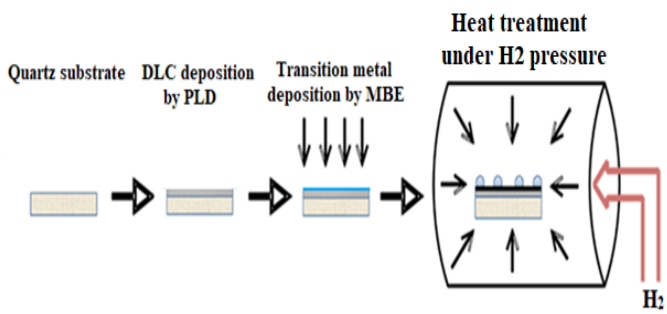

Figure 1 *Steps of the sample preparation*

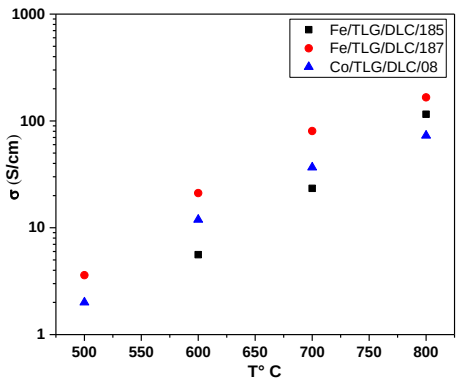

Figure 2 *Conductivity spectra of* Co,Fe/TGF/DLC/Quartz *samples*

Références:

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