Engineered nanocarbon surfaces for nanomedicine

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INTRODUCTION: The research of new materials and multimodal architectures for nanomedicine is today a rapidly developing research area and functional systems engineered at the nanoscale are finding wide application for prevention, diagnosis and treatment of diseases. These systems provide promising alternatives to conventional biosensors, and open completely new routes to imaging/labeling, to drug delivery, to fabrication of micro- and nano-scale scaffolds for tissue growth.

However, for biomedical applications, composition and structure of the surfaces contacting biological systems must meet strict requirements in terms of biocompatibility and long-time reliability.

Recent researches demonstrated that, among the inorganic materials used in nanomedicine, the sp^2 and the sp^3 hybridized nanocarbons have the primacy.

It has been proven that nanodiamond is excellent substrate for the adhesion and growth of several types of cells in vitro, and that its surface can selectively bind various biological molecules. In this context, nanodiamond can be considered a good candidate for bio-implants, for controlled administration of therapeutic agents, as well as an ideal surface for site-specific targeting/labeling and for sensing/detecting biological systems[1,2].

As regards sp^2 carbon, fullerenes, graphite nanoplatelets, carbon nanofibers and nanotubes have been tested as drug delivery platforms, as sensing elements and reinforcing agents for bio-devices, as tools for separating and purifying biological systems.

RESULTS: In our labs a variety of different strategies are being explored to prepare specifically shaped surfaces enabling nanocarbon-based bioapplications. In particular, graphitic dendrimers with various size, shape, branching and surface functionality and nanodiamond systems formed by elongated structures (nanorods, nanowhiskers, nanopillars nanocones) are proposed as attractive scaffolds for tissue growth, for selective attachment of targeting groups and for bioanalytical applications.

This presentation will illustrate some relevant synthetic strategies for the engineering of nanocarbon-based platforms and some examples of multivalent architectures for bio-related applications.

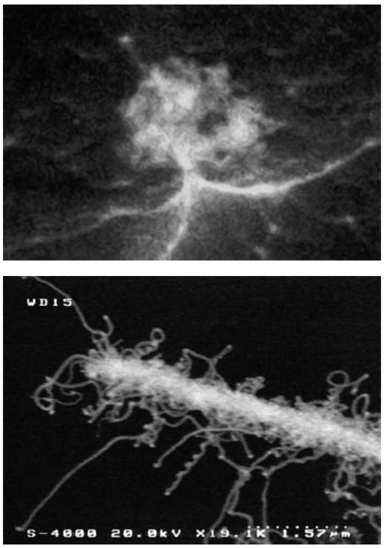

Fig. 1: Examples of dendridic carbon structures.

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