**“Novel synthetic approaches for the development of functional 2D hybrid materials for energy, environmental and biomedical applications”**

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Much of the research effort on 2D materials focuses on its use as building block for the development of novel hybrid structures with well-defined dimensions and behavior suitable for applications among else in gas storage, heterogeneous catalysis, gas/liquid separations, nanosensing and biology. Towards this aim, novel nanostructured pillared materials based on graphene-based matrices (graphene, graphene oxide and graphite nitrate)1-9 and other 2D materials like germanane (GeH)10-13 with high surface area, tunable pore size and aromatic functionalities have been synthesized and studied by using top-down (bulk synthesis) and bottom-up (by combining the Langmuir-Schaefer and the self-assembly techniques) synthetic approaches. Hybrid materials were characterized by a combination of analytical techniques. Representative case studies addressing cutting edge processes of great importance such as the use of these hybrid nanostructures as catalysts, phase change materials, cytotoxic agents, effective adsorbents for environmental remediation, conductive inks and gas (H2 and CO2) storage materials will be discussed.

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