

## **Bio-inspired synthesis and self-assembly of few layer graphene**

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The future development of advanced materials depends on several aspects, which are first of all linked to synthesis and then exploitation of the materials in an efficient way. This concerns also the graphene based materials and despite the huge number of efforts devoted to the synthesis of graphene and few layer graphene (FLG) there is still lack of the methods allowing their high scale production together with environment respect. Their efficient use in composites, polymers and films in order to provide or enhance graphene-related properties such as high conductivity, transparency, flexibility, mechanical resistance will depend on the way these "nano" materials are arranged in the macroscopic media. Herein, the bio-compatible, high yield production of solution processable FLG is presented (patent)<sup>1</sup> together with a new approach of bio-inspired FLG self-assemblies into fractal like patterns (presently under patent application). Such FLG self-assemblies reduce the percolation threshold between

FLG flakes allowing the percolation at lower amount of FLG for a given surface if compared to the random arrangement (fig. below).<sup>2</sup> This can find the application in transparent conductive films (TCF), where the FLG self-assemblies patterns can be optimized in order to achieve variable transparency-conductivity properties according to the TCF final use. This interesting finding recalls the natural tendency of Matter to self-organize into functional systems. The fractal like, branched structures are commonly observed in numerous natural systems being in charge of transport function, such as river beds, trees or neural system.

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