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Mechanics of 2D and 3D graphene ensembles and related composites under impacts and other extreme mechanical loads

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The shielding from high-speed impacting projectiles or shock loads can be easily achieved with massive structures which, however, are not usually compatible with the requirements of real technological applications, such as flexibility and ergonomics in body armors or extreme lightweight requirements in spacecrafts. In this scenario, nanomaterials are very promising to reach unprecedented specific toughness (per unit mass). In this talk, concepts about the behavior and optimization of multilayer composite structures will be introduced and elucidated by computational modeling, with focus on graphene- and other 2D-materials-based composite armors. Furthermore, the 3D foam structuring of such 2D-materials allows to exploit the high strength and toughness observed at the nanoscale while tremendously reducing weight at the macro-level. In this perspective, the peculiar mechanics of the recently synthesized hollow aerographite networks (porosity > 99%) will be presented.

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