2D $MoSi_2N_4$ family and HOPG-like graphene films

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Identifying new 2D materials and developing new synthesis methods are essentially important for the applications of 2D materials. I will first introduce a newly emerging artificial 2D layered material discovered by my group, $MoSi_2N_4$ [1], which has no natural counterparts and is grown by chemical vapor deposition [1-3]. It can be viewed as a monolayer MoN (MoN_2) sandwiched between two Si-N bilayers and exhibits semiconducting behavior (bandgap, ~1.94 eV) with a potentially high carrier mobility up to 1200 cm^2/Vs, high strength (~66 GPa), and good thermal conductivity (~200 W/mK) [1,3]. Motivated by the discovery of $MoSi_2N_4$, a large family of such structured materials with a general formula MA_2Z_4 have been predicted [4], including semiconductors, metals, magnetic half-metals, superconductors, and topological insulators. Then, I will demonstrate the synthesis and industralization of HOPG-like highly conductive graphene films for heat dissipation, which include the efficient and green synthesis of graphene oxide by water electrocatalysis [5], scalable fabrication of highly ordered and compacted graphene oxide laminates by centrifugal casting [6.7], and in particular, our recently developed defects promoted highly efficient graphitization strategy [8].

References

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Figures

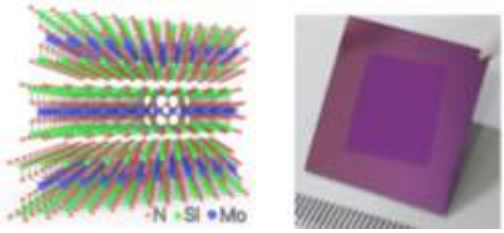

Figure 1: The structure of $MoSi_2N_4$ and a monolayer $MoSi_2N_4$ film grown by chemical vapor deposition.

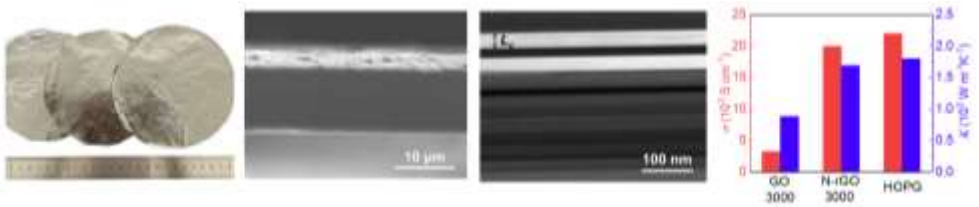

Figure 2: HOPG-like graphene films synthesized by defects promoted graphitization strategy.