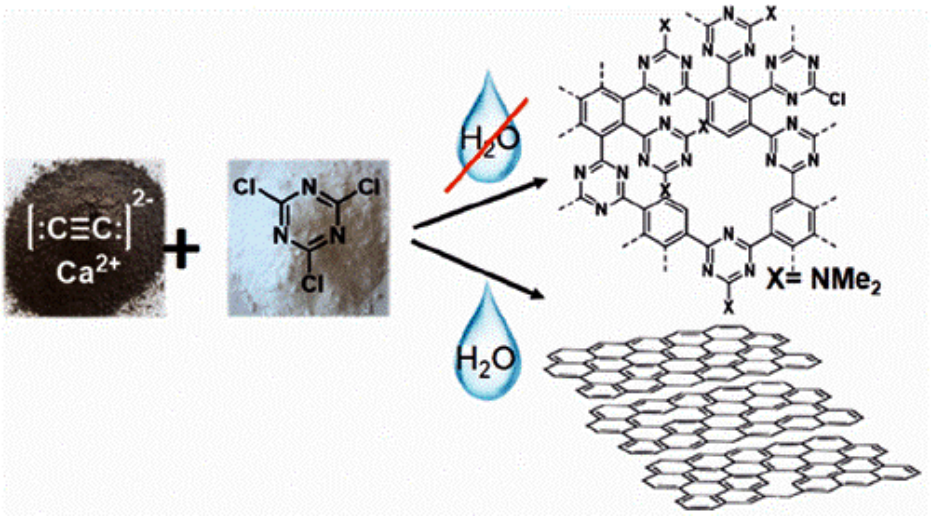
Metal-Assisted and Solvent-Mediated Synthesis of Two-Dimensional Triazine Structures on Gram Scale

Covalent triazine frameworks are an emerging class of materials that have shown promising performance for a range of applications. In a large collaborative project, researchers from IRIS Adlershof together with their partners report on a metal-assisted and solvent-mediated reaction between calcium carbide and cyanuric chloride, as cheap and commercially available precursors, to synthesize two-dimensional triazine structures (2DTSs) [1]. The reaction between the solvent, dimethylformamide, and cyanuric chloride was promoted by calcium carbide and resulted in dimethylamino-s-triazine intermediates, which in turn undergo nucleophilic substitutions. This reaction was directed into two dimensions by calcium ions derived from calcium carbide and induced the formation of 2DTSs. The role of calcium ions to direct the two-dimensionality of the final structure was simulated using DFT and further proven by synthesizing molecular intermediates. The water content of the reaction medium was found to be a crucial factor that affected the structure of the products dramatically. While 2DTSs were obtained under anhydrous conditions, a mixture of graphitic material/2DTSs or only graphitic material (GM) was obtained in aqueous solutions. Due to the straightforward and gram-scale synthesis of 2DTSs, as well as their photothermal and photodynamic properties, they are promising materials for a wide range of future applications, including bacteria and virus incapacitation.



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