Advancing metal-free photocatalyst for hydrogen production from water; polycondensation mode of molecules, organic crystals, and polymers in an eutectic mixture

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Photocatalytic water splitting is a viable way to produce hydrogen in a sustainable manner where catalyst is a crucial component to drive the non-spontaneous reaction ($\Delta G > 0$) under sunlight. One promising candidate is graphitic carbon nitride (g-CN), a graphite analogue. Although it has shown a superior photocatalytic activity to the conventional oxide based semiconductor, g-CN is an only moderately efficient photocatalyst under visible light yet. This mainly results from the limited absorption of visible light and fast charge recombination at defect sites. In this context, we previously utilized polymeric derivative of g-CN (DCDA-550) as a precursor and investigated its polycondensation mode in an eutectic mixture of LiBr:KBr for low defect density. Herein, we further introduce different form of precursor, an organic crystal of melamine-cyanuric acid complex (MCA). It will be shown how solubility of dicyandiamide (DCDA), DCDA-550, and MCA in the eutectic medium at 550 degrees C affects the polycondensation mode and thus chemical/electronic/photocatalytic properties of the resulting g-CN materials.