New modifications of carbon nitrides and their use in artificial photosynthesis and single atom support

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Some recent observations made polymeric graphitic carbon nitride a valuable extension to current semiconducting organic materials. This is due to the ease of synthesis, but also due to its extreme chemical stability. Made from urea under early-Earth conditions, as reported already by Justus Liebig in 1832, it just recently turned out to be a novel catalyst which, among other reactions, can even chemically activate CO_2 or photochemically turn water into hydrogen, oxygen, or more valuable compounds. This opens the door to a new chemistry on the base of a sustainable and most abundant polymer base.
I will report in this presentation on new, COF-like, ionic members of the carbon nitride family which are highly crystalline and have an even increased stability with HOMO potentials down to 2.7 V. This accesses not only a cocatalyst-free full artificial photosynthesis, but also new semiconductors uses in organic electric devices that could previously not be addressed. I will also talk about photochemical pumping with carbon nitride nanostructures and how that adds an engineering component to carbon nitride photocatalysis.

Due to the positive work-function the new versions are remarkably suitable for single atom deposition and thereby also a key step to extend the electron density range of known metals. Here I report on photochemical H_2O_2 synthesis and methane mono-oxidation enabled as such.