

Nanoscale insights into carbon nitride materials: from short-range order analysis to in-operando studies

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Carbon nitrides attract a lot of attention for various technological applications in the areas of catalysis, carbon capture, energy supply and storage. The performances of these materials in real devices rely critically on controlling their nanostructural properties. Understanding the structure of carbon nitrides is a long-standing challenge by itself, since many of these compounds are complex, often poorly crystalline or amorphous materials, which are difficult to characterize by standard diffraction methods. In order to be able to control properties of existing carbon nitrides and design new compounds, characterisation of the final products is not enough, and the ability to follow nanostructural transformations in-situ and in-operando becomes essential. In my talk I will demonstrate how the use of advanced transmission electron microscopy methods (energy-filtered electron radial distribution function analysis, in-situ heating and in-operando electrochemistry studies) help to get detailed insights into structure-property relations and assist the development of new carbon nitrides. Carbon nitrides used in different technological applications (photocatalysis, CO₂-sorption, energy storage (as anodes in Na-ion batteries))) will be discussed in this talk.