TITLE: Simply Black Magic: towards a low(er) temperature sol-gel chemistry of carbon materials

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ABSTRACT:

In times of sustainability, structures carbon materials with functionality made of biomass are a convincing choice. Here, the notation “carbon” is rather broad and includes a diversity of compounds with different composition, hybridization motifs, textures and the related properties. A common denominator is however that all these carbons are made by high temperature engineering processes where start and end situations are just very indirectly related (“structural loss”), not mentioning the energy loss. How much easier it would be to have a sol-gel chemistry towards such functional nanostructures available?

I will summarize in my talk some of the recent approaches to make a sol-gel chemistry of functional carbon nanostructures to come one step closer:

- Hydrothermal condensation is runned at around 200 °C, a classic, and the path of geology towards coals. Solvothermal reactions towards so-called C-Dots turned out to be heterocycle chemistry and polymeric framework formation. This is a Stöver-like process, but the products are rather engineering plastics. We however expanded the disclosed reaction scheme towards catalyst design.

- The way of Nature to low temperature carbonization is Coenzyme A activated carboxylic acid condensation and dehydration, which in principle can take place at ambient temperatures. Mimicking this reaction with metaphosphate activation gives typical sol-gel textures of very appealing und previously not available carbon materials.

- Carbonsuboxide as a monomer seems to be the most promising path for lower temperature carbon condensation. The first formed “red carbon” is a tecton, which is able to undergo a variety of further condensation schemes towards functional solid state materials with the wanted functionality.