„Chemistry under extreme conditions – from polycations with 1D metal behaviour to reactions under GPa pressure“

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Rude colleagues say that solid states chemists follow for their reactions only the principle "shake and bake". Of course, high temperatures help to overcome activation barriers. However, we all know that this is not enough. A multitude of other parameters play an essential role for efficient solid-state reactions. I will present you how we use extremely strong oxidizing agents, such as sulfuric acid or its anhydride SO_3, to synthesize silicate analogous materials such as borosulfates. In these, the charge compensating heteropolyanionic subunits are composed of vertex-linked (SO_4)- and (BO_4)-tetrahedra. In contrast to the immense structural diversity of silicates, the number of borosulfates is yet very limited and the extent of their properties is still unknown. Furthermore, allow the extreme reaction conditions for the stabilization of cationic species with unprecedented properties, like 1D metal behavior in $[Au_2Cl_4](B(S_2O_7)_2](SO_3)$. In an effort to expand the knowledge on oxoanionic networks even further, we have also gone and tested our systems on rhenates, manganates and technetates. In this context, the handling of technetium and its compounds is another challenge. In addition to the acids, strong alkaline media can be a perfect medium for the synthesis of oxidic and oxoanionic materials, and the application of pressure in O_2 gas autoclaves or the use of a Multianvil press (p_{max} = 26 GPa) allows for investigations of the afore mentioned reactions in a regime that is still almost unexplored.

Using a wide array of analytical methods such as optical spectroscopy, magnetochemistry and photoelectron spectroscopy we try to investigate all samples as detailed as possible and corroborate our findings by quantum chemical calculations.

I will therefore present an overview of our investigations on borosulfates and oxometallates, the effects of the counter cations on the chemistry and some results of high pressure approaches. It will turn out that “shake and bake” does not always hold true, and that there is more to solid state chemistry than meets the eye.