Presentation title: The influence of complex cobalt(III) cations and synthetic methods on polyoxovanadate formation

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Abstract:

Polyoxometalates (POMs) represent a large group of compounds that, due to their unique structures and interesting optical, electronic and magnetic properties, find their application as model systems in homogeneous and heterogeneous catalysis, as antitumor and antiviral reagents, and as magnetic materials. The main driving forces responsible for the formation of polyoxometalates are various interactions and self-assembly processes between smaller building blocks, such as $[VO_4]^{3-}$. Our research is focused on examining the conditions for the formation of complex salts made of polyoxovanadate anion and complex cations of cobalt(III) with the aim of defining the influence of macrocations on the self-association process. The macrocationic species prevent rapid aggregation of polyoxovanadates, stabilize intermediate building units and direct their self-association. Polyoxovanadate anions with cobalt(III) macrocations were prepared by several different synthetic methods which include synthesis at room temperature, at elevated temperature, or at elevated temperature and pressure (hydrothermal synthesis), as well as liquid-assisted grinding with vapour-assisted aging. Ammonium vanadate and tetraammineoxalatocobal(III) nitrate were used as the precursors for the synthesis, as well as succinic acid. Although succinic acid was not found to be present in any of the isolated products, its presence appeared to be essential for the polyoxovanadate formation. The reactions were also carried out in the presence of sodium molibdate. Several new compounds were isolated and characterised using elemental analysis, infrared spectroscopy, thermal analysis and X-ray diffraction on a single and polycrystalline sample. In order to confirm the oxidation states of the transition metal ions ESR spectroscoy was used. Most of the isolated compounds contained decavanadate anions, while one contained a molybdovanadate anion.

Biography:

Dino Kuzman obtained his Master's degree in 2017 at the Faculty of Science, University of Zagreb. He is currently working as an expert associate at the Depatrment of Chemistry, Faculty of Science, University of Zagreb where he continued his studies to obtain a PhD degree. His research includes the design, synthesis and characterization of novel inorganic and organic-inorganic polyoxometalate-based compounds. Focusing on the solid-state chemistry of prepared compounds, he utilizes different characterization techniques (thermal analyses, X-ray diffraction and IR spectroscopy) to study the correlation of the compounds' structures and their properties.