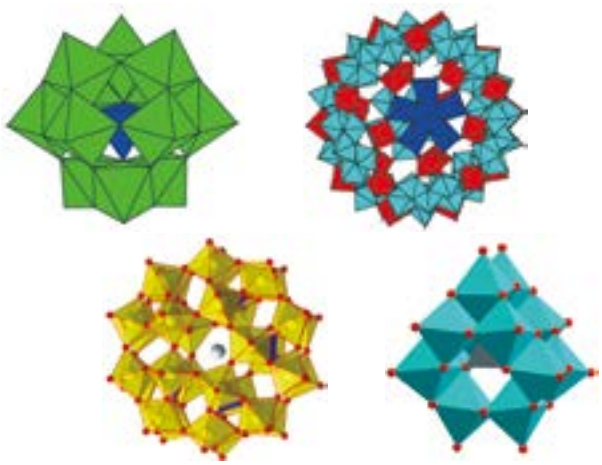
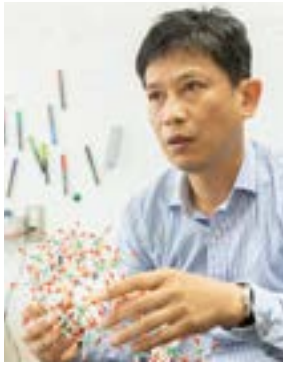
Joy of discovering new metallic oxide molecules that serve society



Polyhedron illustrations of the polyoxometalates (POMs: metallic oxide molecules) handled by Prof. Sadakane. Either in liquid or solid state, POMs have a high degree of acidity, even higher than sulfuric acid, and are frequently used as industrial catalysts and in manufacturing methacrylic acid. Methacrylic acid is an important raw material of highly transparent and strong acrylic resin (used for such objects as transparent fish tanks for aquariums, contact lenses, lighting fixtures, and automobile headlight covers).



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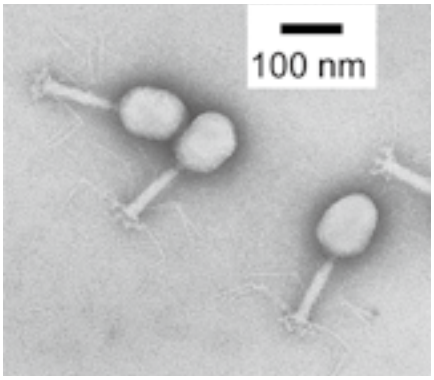
Research interests

Inorganic chemistry, metallic oxides, catalysts, viral stains

Perhaps many of you remember learning in high school science classes that many metals react to oxygen in water or in the atmosphere and produce oxides. Many elements from alkaline earth metals to transition metals generate metallic oxides. Since ancient times, our ancestors have been using metallic oxides to enrich their lives, as exemplified by their use in ancient earthenware and glass vessels and as raw materials in metal smelting.

My research concerns oxide molecules generated by transition metals, such as tungsten (W), molybdenum (Mo), and vanadium (V). What I find fascinating about my research is that it is possible to synthesize differently structured oxide molecules by changing elements to combine and synthesizing conditions. Their shapes can be highly varied: globular, disk-like, football-shaped... It requires a lot of time and effort to synthesize new compounds and clarify their structure, but you often have the chance of discovering ones with breathtakingly beautiful structures. What is more, some of those beautiful compounds also have properties that can be useful for society. For example, some metallic oxide molecules are highly acidic or have oxidation-reduction reactions that transfer electrons. For such properties, they can be used as catalysts in the production of chemicals that are essential in modern life.

Metallic oxide molecules can also be used as stains to render visible viruses that are normally invisible under an ordinary light microscope. This is an application of the weight of elements such as tungsten and molybdenum. Recently, we have demonstrated that the use of a compound we have synthesized makes it possible to obtain a very clear image of the novel coronavirus.



POM compounds, because they are heavy, can be used as viral stains for electron microscopy, which realizes vivid images showing even very small details such as the "tail" of a virus.

At Hiroshima University, students can study chemistry in various divisions, including the Schools of Science, Engineering, and Education. At the School of Engineering, our ultimate goal is concrete realization. In life, there are many things that we cannot fully control or manage on our own, such as viruses, warfare, and natural disaster. Still, we at the School of Engineering endeavor to design and realize concrete solutions based on scientific knowledge, to meet society's needs and overcome various challenges, by using available resources in the best possible manner. If you are interested in serving society through chemistry, I urge you to come and study in the chemistry cluster within the School of Engineering. My research unit carries out many joint international research projects, and our students have many opportunities to study at our partner research institutions overseas. I sincerely hope that the COVID-19 situation will be resolved so that students can freely travel abroad for their study and research at the earliest possible time.