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Inorganic nanoparticles as enzyme mimics

A long-standing goal of biomimetic chemistry is the design and synthesis of functional enzyme mimics. The past three decades have seen a wide variety of materials including metal complexes, polymers and other biomolecules that mimic the structure and function of naturally occurring enzymes. Among these, inorganic nanoparticles bear a huge potential, because they are more stable than their natural counterparts, while having large surface areas and sizes comparable to those of natural enzymes. Therefore, a considerable number of "artificial enzymes" derived from inorganic nanomaterials has been reported. We highlight recent progress in the field of enzymatically active inorganic nanomaterials. They are discussed based on nanoparticle properties in solution, particle uptake in cells and clearance and based on catalytic activities of nanoparticles compared to those of the natural enzyme. The aim of this overview is to determine - or even predict - which chemical type of nanoparticles is of special interest for further research in enzyme mimetics. Of all nanoparticles discussed, vanadium oxide, molybdenum oxide, cerium oxide, magnetite nanoparticles and molybdenum oxide films showed catalytic activities and stabilities comparable or superior to those of natural enzymes. Some medical and biotechnological applications of enzyme mimics and some prospects for further research are outlined.

Biography

Wolfgang Tremel studied chemistry and medicine at the universities in Bielefeld and Münster. He received his PhD in chemistry from the University of Münster in 1984. After postdoctoral stays at the Hahn-Meitner Institute in Berlin, the DESY/ Hasylab in Hamburg, Cornell University and Iowa State University he moved to Münster to complete his Habilitation. 1991 he joined the chemistry department in Mainz as an associate professor and was promoted full professor for inorganic chemistry in 1996. He has served several years as department chairman and as chairman of the materials science center. He has been an editorial board member of the Journal of Solid State Chemistry and Chemistry of Materials and an associate editor of the Journal of Solid State Chemistry. He is currently an associated editor of Dalton Transactions. He has π400 publications that have been cited π10000 times. His current publication h-index is 53.

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