Elaboration of photopolymerized acrylate/zeolite composites with nano-ZnO

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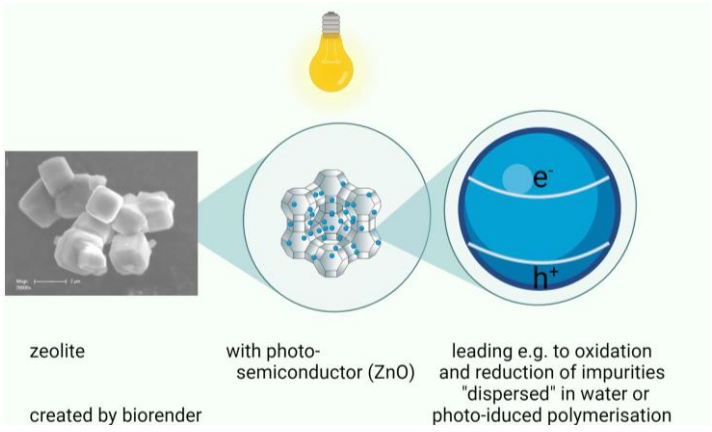
This study takes a multidisciplinary approach to existing know-how in research based on zeolite materials, photo curable resins and nanoscaled ZnO particles which exist on the Institut de Science des Matériaux de Mulhouse. [1,2]

Radical photopolymerization processes are widespread in industry (for coatings, paints, inks, varnishes, etc). Polymer/zeolite-based resins are interesting to design zeolitic objects by 3D printing by photopolymerization.The incorporation of ZnO nanoparticles in a resin composed of acrylate monomers and zeolite as filler could favor a bulk photopolymerization without organic initiator. A reactive nanoparticle-based photoinitiator is a system in which the nanoparticle itself can act as a receiver for the electromagnetic waves of the irradiation light source. ZnO is an appropriate candidate due to its basic character and solubility. The basic character could also have a positive effect on the interaction with zeolite material. The large variability of the zeolite material allows different approaches that could be beneficial, e.g. the improvement of the storage stability of the ZnO-based system could be achieved by combining ZnO attached to the zeolite surface. Curently powder-based ZnO nanoinitiators are not possible, they contain a significant amount of solvent.[2] Retaining the bioactive and photocatalytic properties of the photosemiconductor together with the given structure and adsorption properties of the zeolite material and variable organic matrices could allow obtaining reactive material for e.g. photodecomposition. Situations where the organic matrix can be completely removed (both inorganic materials are more heat resistant) could lead to 3D-printed composites and monoliths (heat-treated composites) that have applications in the field of adsorption, e.g., in (photo)catalysis. The good solubility of ZnO in both acid and in alkaline solution potentially prevents the accumulation of nanoparticles in bodily tissues. If consumed, ZnO nanoparticles rapidly decompose in nearly any acid, resulting in non-toxic zinc ions.



Scheme 1 : Illustration of zeolite material decorated with ZnO.

[1] Y. Gao, **J. Lalevée, A. Simon-Masseron**, Advanced Materials Technologies 8, 2300377 (2023).
[2] **M. Schmitt**, Nanoscale, 7, 9532-9544 (2015).