

Synthesis and Properties of Nanostructured $\text{Zn}_x\text{Ti}_y\text{O}_z$ Powders and Coatings

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Solid state reactions of ZnO and TiO_2 powders at different Zn/Ti atomic ratios offer various microcrystalline phases such as hexagonal ZnTiO_3 , cubic spinel Zn_2TiO_4 and defect spinel $\text{Zn}_2\text{Ti}_3\text{O}_8$, respectively [1]. Some of these ternary heterostructures have been recently prepared by the sol-gel process, too [2]. Zinc titanates are promising candidates for high quality microwave dielectrics, nonlinear optical coatings and perhaps for solar energy conversion materials, often having superior electrical properties and stability compared to bare TiO_2 and ZnO .

This talk gives an overview about our current research directed towards chemical elaboration of nanostructured $\text{Zn}_x\text{Ti}_y\text{O}_z$ powders and coatings in the presence of various additives. In our previous studies, ethanol born $\text{Zn}_x\text{Ti}_y\text{O}_z$ nanostructures have been successfully used in nitridation process [3] and in photocatalysis driven by visible light [4].

More recently, we detected natural superhydrophilicity of $\text{Zn}_x\text{Ti}_y\text{O}_z$ coatings that correlates with their photocatalytic performance. Addition of organosilanes stabilizes the superhydrophilic character related to the formation of gradient coatings. We will discuss the activation and ageing of water wettability at different atomic Zn/Ti ratios and various sintering conditions. In addition to water contact angle measurements, we also studied structural and surface chemical properties of these nanocoatings that will be presented as well. Furthermore, the nanostructural evolution is completely changed if these nanoheterostructures are functionalised with lanthanide cations such as Eu^{3+} . We note a substantial shift to higher sintering temperatures needed to induce the nanocrystallisation process. In addition, Eu^{3+} stabilizes the defect spinel phase at higher temperatures and delivers samples with the highest red fluorescence intensity.

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