DESIGNING SYNTHETIC APPROACHES TO THERMODYNAMICALLY CHALLENGING OXIDE PHASES

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Potentially attractive oxide materials, involving metal cations in unusual chemical compositions or in coordination environments poorly suited for them, are difficult to produce as pure single phases. Soft Chemistry offers an attractive route to such materials, facilitating building of an oxide phase via transformation of poorly chemically or thermally stable precursors. The latter can decompose under mild conditions with formation of a desired oxide. Especially interesting are situations when a complex precursor, containing the target cations in the same molecule in proper stoichiometric ratios, can be constructed. Such complex oligonuclear species are erroneously often referred to as “clusters”, which implies that building of such compounds should provide their chemical composition and structure with some enhanced stability. In reality, such species, especially when they are containing alkoxide ligands, are rather reactive and easily transform further with possible change in both structure and stoichiometry on the way to oxide nanomaterial. We propose to introduce for them an alternative term “paperbag”, to avoid unnecessary expectations.

In the present study, we combined two soft-chemistry techniques, creating first the precursors involving the desired metal cations via hydrolytic approach, and then converting them under mild conditions into the desired oxides via Metal-Organic Decomposition (MOD) technique. We report here application of this strategy to preparation of titanium molybdate, TiMoO5 [1] and of rare earth doped titanium oxide, REE:TiO_2 [2] (See Fig. 1).

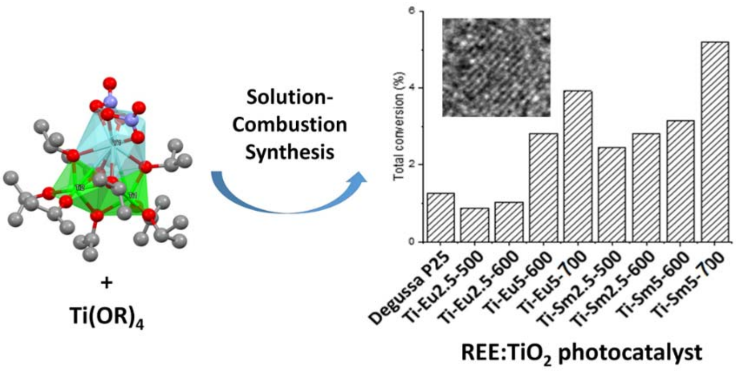

Figure 1. Soft Chemistry route to REE:TiO_2 and its photocatalytic properties [2].

[1] H. Uchiyama et al., *Inorganic Chemistry* **2021**, *60*, 3593-3603.

[2] F.G. Svensson et al., *Inorganic Chemistry* **2021**, 60, 14820−14830.