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Environmental assessment of different synthetic strategies towards engineered oxide nanomaterials

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In the evaluation and selection of a particular synthetic strategy for the preparation of desired engineered nanomaterials, careful considerations on the size and the shape of nanocrystals must accompany the conventional considerations related to the yield, reaction time and cost of the precursors. Moreover, in order for inorganic chemistry to pursue a sustainable development, green metrics assessments are becoming always more popular. Among the different soft chemistry strategies available for the synthesis of engineered nanomaterials, some of the most intriguing and effectively employed ones have been compared in this work, in terms of their environmental as well as human health assessments. Particularly sol-gel synthesis (both hydrolytic and non-hydrolytic) and solution combustion synthesis are the three synthetic strategies selected for this comparative study. Anatase TiO_2 nanoparticles have been identified as the ideal material, since it is probably the most studied and applied semiconductor and photocatalyst, owing to its unique physicochemical properties. First approximated environmental evaluation from the mere chemical point of view has been performed with the software EATOS (Environmental Assessment Tool f or Organic Syntheses). Subsequently, complete cradle to the grave analyses has been conducted by the Life Cycle Assessment (LCA) methodology, allowing considering further fundamentals damage categories. This study represents a pioneering work for the establishment of environmental and human health impacts rankings, comprising all the possible synthetic approaches to a desired nanomaterial. Preliminary results and future perspectives related to the scaling-up of selected syntheses as well as the possibility of employing alternative heating techniques will be presented as well.

Biography

Roberto Rosa has graduated in Chemistry from the University of Modena and Reggio Emilia, where he also obtained his PhD in Materials Science. Currently, he is a Postdoctoral Research Fellow at the same university. His main research interests are related to the application of microwaves as alternative and efficient energy form in the inorganic syntheses of engineered nanomaterials in the green extraction of phytochemical compounds and in materials processing in general. He is the co-author of more than 30 publications in reputed scientific journals.

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