Polymerisation-induced Self-Assembly (PISA) Nanoparticles as Guiding Templates for TiO_2 nanostructures

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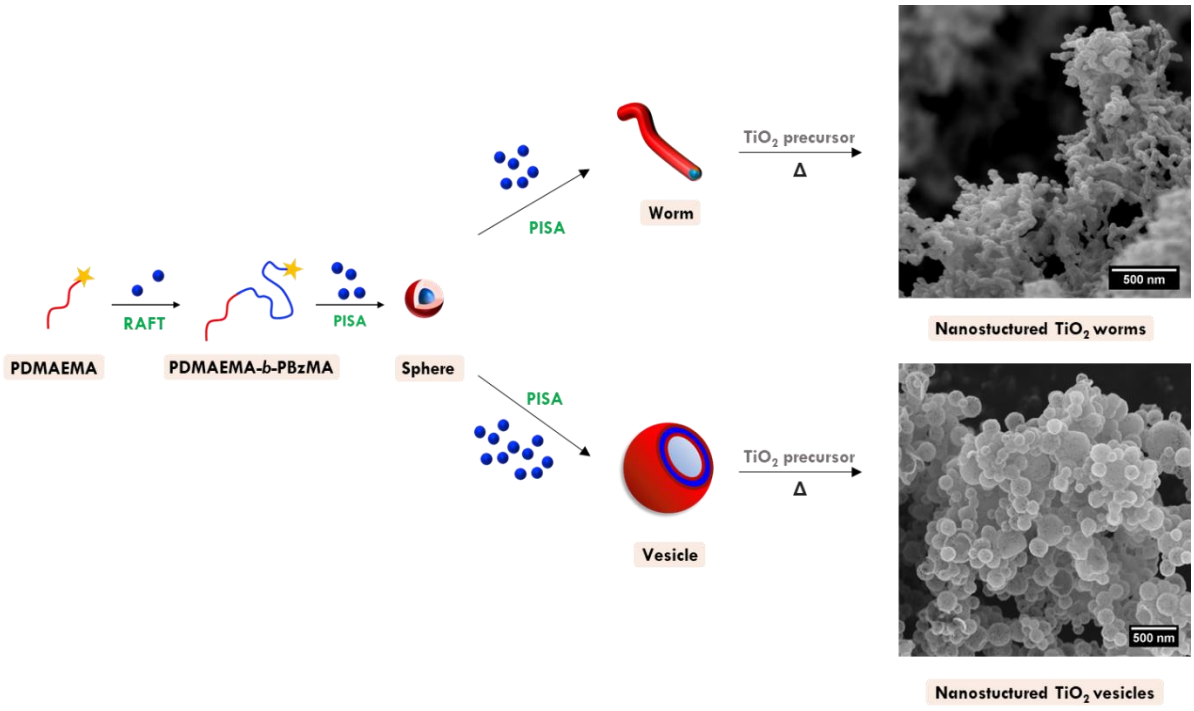
Research in nanostructuring of metal oxides has started gaining momentum as it allows for the fine tuning of their structural, physical and chemical characteristics, further rendering them useful for a wide range of electronic, catalytic and sensing applications. Particularly, soft templating approaches involving synthetic polymers have further nourished the development of metal oxide nanostructures as they provide an avenue for the precise control of their morphology, shape and particle size.[1–3] In this presentation, we will demonstrate the leverage of polymerisation-induced self-assembly (PISA) as a versatile approach to prepare polymeric nanoparticles as soft templates to fabricate hollow TiO_2 nanostructures (Scheme 1).[4] To this end, poly(2-dimethylaminoethyl methacrylate)-block-poly(benzyl methacrylate) (PDMAEMA-*b*-PBzMA) diblock copolymers were synthesised using alcoholic reversible addition-fragmentation chain-transfer (RAFT) polymerisation, which allowed for *in situ* generation of polymeric nanoparticles bearing different morphologies. By exploiting their shape and compartmentalisation between the two blocks of PDMAEMA-*b*-PBzMA in the nano range, these polymeric nanoparticles were applied as soft templates for nanostructuring TiO_2. This can be achieved by simple electrostatic complexation between the PDMAEMA block of the block copolymer and titanium(IV) bis(ammonium lactato) dihydroxide (TALH), a water-soluble TiO_2 precursor. Such facile approach has rendered the formation of TiO_2 (anatase) nanostructures in well-defined porous worm and vesicular morphologies.



Scheme 1. Schematic representation of polymerisation-induced self-assembly (PISA) and the SEM images of TiO_2 nanostructures templated from the as-prepared polymeric nanoparticles.

References

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