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GISANS study on whey protein and titania interfaces: Influence of pH on spray deposited biohybrid film morphology

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Interfaces based on metal oxides play a major role in functional materials for energy applications. For example, TiO2 can serve as a photocatalyst in the production of hydrogen or as an anode material in emerging solar cell and battery technologies. In most applications, a designed structure is highly de-sired to fulfill performance conditions on different length scales. Moreover, devices benefit from a high interfacial area between functional layers and hence nanostructured TiO2 of high surface-to-volume ratio is favorable. Designed morphologies can be achieved and fabricated by industrial rele-vant, low-cost solution processing, e.g. spray deposition, with the help of diblock copolymer directed sol-gel synthesis. However, involved organic solvents limit the potential in environmentally friendly processing when it comes to an industrial scale. To overcome this, synthetic copolymers can be re-placed by water-soluble biopolymers. The bovine whey protein forms aggregates of different structures by denaturing at different pH values that can act as a template in water-based TiO2 synthesis. Different biohybrid films are obtained by spray deposition from the solutions at different pH. The films are in-vestigated with bulk and surface-sensitive grazing-incidence small-angle neutron scattering (GISANS) to understand the influence of pH on the morphology. The obtained results are complemented by real-space imaging.

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