



Contribution ID: 53

Type: **Poster**

Bio-hybrid thin films for templating titania nanostructures

Wednesday, 11 December 2019 15:40 (20 minutes)

Polymer based films are of high practical use, e.g. as coatings, biomedical applications or flexible electronics. In combination with inorganic materials, this films form interesting hybrid systems of elevated performance, joining advantages of both material classes: Solution processing providing possibilities of cheap industrial fabrication and inorganic characteristics like enhanced electrical, magnetic or drug properties. A novel and promising approach in the field of polymeric soft matter is to substitute these synthetic polymers with environmental biopolymers, such as proteins. Being water soluble, earth abundant and non-toxic, they open a way to green soft matter processing. We are interested in the structure directing properties of the bovine whey protein β -lactoglobulin (β -lg) for thin titania films. For this, denatured β -lg is mixed with established titania precursors to form a sol-gel, which can be eventually deposited. Spray deposition is chosen as a technique of low material wastage. Calcination of the as deposited films combust the biopolymer template and introduces crystallinity into the nanostructured titania. By backfilling the remaining scaffold with the organic semiconductor P3HT, photon sensors can be created. Grazing incidence small-angle X-ray scattering (GISAXS) reveal the film formation in situ during spray coating, as well as in operando morphological degradation of the sensor. GISAXS is complemented by real space imaging, e.g. electron microscopy.

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Session Classification: Poster session

Track Classification: Soft Matter