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Experiment Report Form

ESRF	**Experiment title:** Correlation between charge transfer and structural changes in core-shell particles of Prussian blue analogues with increasing lattice mismatch	**Experiment number**: MA-2966
Beamline: BM30B	**Date of experiment**: from: 04/05/2016 to: 09/05/2016	**Date of report**: 30/08/2018
Shifts: 15	**Local contact(s)**: Olivier PROUX, olivier.proux@esrf.fr	*Received at ESRF*
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Strain engineering of photo-induced phase transformations in Prussian blue analogue heterostructures

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Heterostructures based on Prussian blue analogues (PBA) combining photo- and magneto-striction have shown a large potential for the development of light-induced magnetization switching. However, the studies of the microscopic parameters which control the transfer of the mechanical stresses across the interface and their propagation in the magnetic material are still too scarce to efficiently improve the elastic coupling. Here, this coupling strength is tentatively controlled by strain engineering in heteroepitaxial PBA core-shell heterostructures involving a same $Rb_{0.5}Co[Fe(CN)_6]_{0.8}.\ zH_2O$ photostrictive core and isostructural shells of similar thickness and variable mismatch with the core lattice. The shell deformation and the optical electron transfer at the origin of photostriction are monitored by combined *in situ* and in real time synchrotron x-ray powder diffraction and x-ray absorption spectroscopy under visible light irradiation. These experiments show that rather large strains, up to +0.9%, are developed within the shell in response to the tensile stresses associated with the expansion of the core lattice upon illumination. The shell behavior is however complex, with contributions in dilatation, in compression or unchanged. We show that a tailored photo-response in terms of strain amplitude and kinetics with potential applications for a magnetic manipulation using light requires a trade-off between the quality of the interface (which needs small lattice mismatch i.e., small *a*-cubic parameter for the shell) and the shell rigidity (decreased for large *a*-parameter). A shell with a high compressibility that is further increased by the presence of misfit dislocations will decrease its mechanical retroaction on the photo-switching properties of the core particles.

Published in Nanoscale, 2018, 10, 16030 - 16039

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