Title: Tracking diffusion with luminescent perovskite nanosensors

Author: Mark Mangnus

Most common catalyst particles are host to a complex network of pores and a substantial fraction of their actives sites may be embedded deep within. It is not always straightforward how reactant and product species diffuse in and out of the particle. In order to rationally design more efficient catalyst structures in the future, it is crucial to get a better understanding of molecular transport in such porous systems.

The goal of this project is to develop a method to track diffusion using luminescent CsPbX3 (X = Cl, Br, I) perovskite quantum dots. Perovskite quantum dots readily undergo anion-exchange reactions when exposed to foreign halide species in their local environment. As the optoelectronic structure of perovskite quantum dots is strongly dependent on the halide composition, anion-exchange processes can be easily visualized: blue-emitting CsPbCl3 nanocrystals may be converted into green-emitting CsPbBr3 or red-emitting CsPbI3 nanocrystals. As such, when incorporated inside a pore structure, CsPbX3 nanocrystals may be used to track the diffusion front of halide ions by means of in-situ optical micro-spectroscopy.