Implementation of a light source in a TEM sample holder for photocatalytic materials characterization applications

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Photocatalysts are of fundamental interest for sustainable energy research because of their wide range of applications and great potential for state of the art and future usages [1]. By means of Transmission Electron Microscopy (TEM) it is possible to give a deep insight in the structure, composition and operation of photocatalysts and to provide information on the compounds inner arrangement and a fundamental contribution for their further optimization [2].

We want to construct a novel specimen holder capable of shining light onto samples inside the TEM allowing real time in situ experiments. The holder is implemented with a laser diode and an optical system that guides the light onto the sample surface with maximum power transmission. The source can be changed and tuned according to the needs, in principle spanning the whole visible and UV light spectrum. It is possible to use the device inside an Environmental TEM (ETEM) in order to expose the specimen to a controlled gas atmosphere during illumination.

The aim is to perform complete and exhaustive characterization of photocatalytic materials under simulated working environment, achieving experimental data on yet uninvestigated aspects. Analysis can be performed on a variety of photoreactive materials and structures, including photocatalysts, photonic devices and solar cells. Furthermore, light can be exploited to reduce or completely compensate charging effects in samples under electron beam exposure [3].

We expect to observe structural and surface rearrangement of the illuminated photocatalysts as well as localized charging effects and variations. We aim to investigate the reaction to gas and light exposure at the nanoscale.

Figure: Photography of the modified holder tip with light shone on a tilted piece of white paper.

References