A mechanistic study of environmental photocatalysts using XAFS/XPS at HESEB

Environmental challenges in the SESAME member nations have necessitated the exploration of innovative approaches to mitigate their impacts. One such approach is the development of tailored photocatalysts for environmental applications. Prolonged droughts and large-scale industrial activities have adversely affected water resources in the region, leading to ecological vulnerabilities and pollution.

The interaction of X-ray photons with materials have been utilized for more than a century to gain insight into physicochemical characteristics and processes. Synchrotron soft X-ray provides robust instruments to simultaneously study the absorption of incident photons and emission of photoelectrons. X-ray absorption methods can be used to determine the interatomic relations in terms of structure and operation of environmental photocatalysts. While X-ray photoelectron spectroscopy can be used to study the underlying surface phenomena. The combined approach taken by beamlines such as HESEB provides the means to investigate the mechanistic of aforementioned processes related to active photocatalysts. This approach grants us a deeper understanding of the mechanisms involved in environmental photocatalysis, paving the way for more effective and sustainable solutions.

In this project we aim to study the effect of doping with exotic elements on structural and surface properties of TiO2.Our project investigates the adsorption/desorption and activity fade mechanisms of environmental photocatalysts. By studying the mechanisms of adsorption/desorption and charge carrier transfer, the activity of such catalysts may be enhanced by means of materials tailoring approaches. Additionally, studying activity fade mechanisms identifies factors limiting stability and performance. Uncovering these insights improves design and optimization of photocatalysts for mitigating environmental challenges.