

# METAL OXIDES FOR PHOTO-ELECTROCHEMICAL FUEL PRODUCTION

## 6 hours Course

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### ABSTRACT

The Photoelectrochemical (PEC) water-splitting (WS) process has attracted a lot of research efforts during the past decades since it represents one of the possible ways to reduce the production costs of hydrogen and other solar fuels. This complicated task can, in principle, be achieved, by PEC WS, in a single step using the largest source of renewable energy: the Sun. The course should furnish the knowledge to the comprehension of the basics of the WS process, and the necessity to go beyond the use of simple electrolyzers that rely on expensive electrocatalysts. An ideal, yet ambitious solution to this problem is the PEC approach. The basic concepts of photoelectrochemical cells are described together with the common materials used for the construction of photoanodes and photocathodes. Different strategies to improve the PEC performances of these materials like doping, nano-structuration and the formation of heterojunctions are also described with some examples. The protection of photoanodes and photocathodes based on typical semiconductors materials like Si, GaAs, InP, etc., in aggressive electrolytes, like KOH, is also discussed. Emphasis is dedicated to the evaluation of the photoelectrodes' performances in terms of charge injection efficiency and recombination processes. Finally, the "conclusions and perspectives" section is dedicated to the possibility of assembling stand-alone PEC cells that don't require the use of external bias, thus minimizing the cost of solar fuels production.

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## PhD Course

3<sup>rd</sup> May 2022, 10:00-13:00 - Aula 19

4<sup>th</sup> May 2022, 10:00-13:00 - Aula 27

via Garzetta 48, Brescia

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