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IL DIPARTIMENTO DI SCIENZE MOLECOLARI E NANOSISTEMI

ORGANIZZA IL SEMINARIO :

Materials and interfaces for photoelectrochemical solar fuel production

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Abstract
The development of robust and inexpensive semiconducting materials that operate at high efficiency are needed to make the direct solar-to-fuel energy conversion by photoelectrochemical (PEC) cells economically viable. In this presentation the strategy of PEC solar fuel production is introduced and our laboratory's progress in the development new light absorbing materials and co-catalysts will be discussed along with the application toward overall solar water splitting tandem cells for H2 production. Specifically, this talk will highlight recent results with the ternary oxides (CuFeO2 and ZnFe2O4) 2D transition metal dichalcogenides, and organic (π-conjugated) semiconductors as solution-processed photoelectrodes. With respect to ternary oxides, in our recent work [1,2] we demonstrate state-of-the-art photocurrent with optimized nanostructuring and addressing interfacial recombination by the electrochemical characterization of the surface states and attached co-catalysts. In addition, we report an advance in the performance of solution processed two-dimensional (2-D) WSe2 for high-efficiency solar water reduction by gaining insight into charge transport and recombination by varying the 2D flake size [3] and passivating defect sites [4]. Finally, with respect to π-conjugated organic semiconductors, in our recent work [5] we demonstrate a π-conjugated organic semiconductor for the sustained direct solar water oxidation reaction. Aspects of catalysis and charge-carrier separation/transport are discussed.
Literature: [1] Chem. Mater. 2017, 29, 4952. [2] Adv. Mater. 2018, 30, 1801612. [3] Chem. Mater. 2017, 29, 6863-6875. [4] Nano Lett. 2018, 18, 215-222. [5] J. Am. Chem. Soc. 2015, 137, 15338.

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