Solar water splitting technology has been considered as one of the most promising methods to produce directly renewable energy (i.e., hydrogen gas) from the water. In spite of many research efforts in the last decade, this system has still lots of challenges in improving solar water-splitting efficiency. In particular, the development of photo-active materials that efficiently convert solar energy to hydrogen is one of the biggest challenges facing many scientists and engineers in this field. In this talk, we will discuss recent our research efforts to achieve high solar-to-hydrogen efficiency of photocatalysts and/or photoelectrochemical cell using various strategies such as surface modification, heterostructure and hybridization. Bismuth vanadate (BiVO₄) that is one of the most promising photoanode materials for use in photoelectrochemical cell will be focused. In the case of the photocatalyst, new hybrid composite photocatalysts synthesized through the hybridization of three-dimensional metal-organic frameworks and two-dimensional nanosheets will be introduced.

**Keywords:** Hydrogen, Photocatalyst, Photoelectrochemical cell, Solar Water splitting