Developpment of a new semi-conductor polymer for solar fuel production, through artificial photosynthesis.

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Developpement of **renewable energy sources** is a major preoccupation for our societies. This being due mainly by the environmental constraints caused by the intensive use of fossil fuels.

Solar energy is by far the most abundant and promising clean energy source, and **solar technologies** such as photovoltaic and artificial photosynthesis are called to play a crucial role.[1] Artificial photosynthesis aims at using solar energy to extract electrons and protons from water in order **to produce highly energetic chemicals: solar fuels** (*Figure 1*).

In the last 40 years, many organics and inorganics catalysts have been developped for the water splitting under visible light. In order to avoid the lack of stability of molecular systems, research has emerged on **heterogenous photocatalysts**, such as carbon nitrides (*g*-C_3N_4).[2]

Recently a **new class of polymer** has been synthetised, giving good results for photodegradation of organic substates.[3] Inspired by these results the efficiency of this photocatalyst for water oxidation was tested.

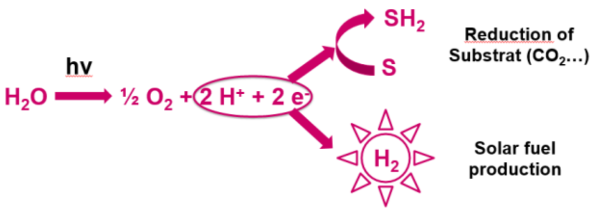

Figure 1 : Target reactions for artificial photosynthesis

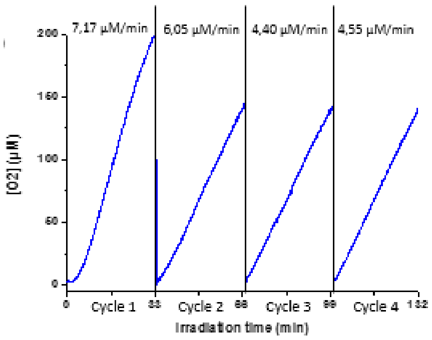

Figure 2 : Oxygen evolution under irradiation over several cycles of photo-oxidation of water by the photocatalyst

This purely carbonated semi-conductor is the **first polymer able to undergo the photocatalysis of water oxidation**, and is reusable for several cycles of photocatalysis. The mechanism has been studied and the electrons and protons coming from this reaction can be stored by reducing a quinone.

[1] Barber, *Chem. Soc. Rev.*, **2009**, *38,* 185;
[2] Wang and Antonietti, *Angew. Chem. Int.Ed.*, **2012**,*51*, 68; Saalfranka and Antonietti, *Phys. Chem. Chem. Phys.,* **2014**, *16*, 15917; Wang and Antonietti, *Nat. Mat*., **2009**, *8*, 76; Liu and Kang, *Science*, **2015**, *347*, 970; Sprick and Cooper**,** *J. Am. Chem. Soc.* **2015**, *137*, 3265;
[3] Gosh and Remita, *Nat. Materials*, **2015,** 505; Gosh and Remita, *New J. Chem.,* **2015**, *39*, 8311.