Dye-Sensitised Semiconductors Modified with Molecular Catalysts for Light-Driven H_2 Production

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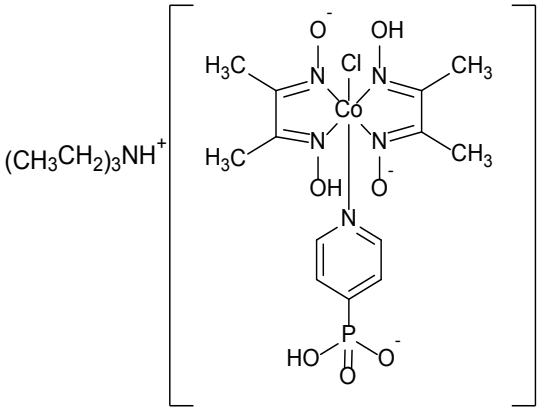

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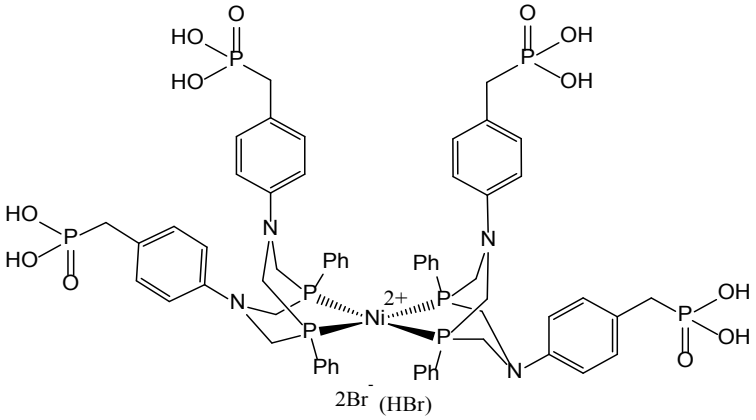

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Renewable energy sources such as photovoltaic power, wind power and biomass conversions to carbon-free energy carriers are growing sources for the decarbonization of the global energy systems. In this respect, hydrogen produced from renewable resources is a potentially promising source of clean energy.

Erwin Reisner and associates from the University of Cambridge have developed cobalt and nickel molecular catalysts that can be used for sunlight driven hydrogen production in water when immobilised on a semiconductor [1].

When semiconducting materials (e.g. TiO_2), co-functionalized with a catalyst and a dye (e.g. Ru or organic dye), are then exposed to light, the dye gets excited and oxidized. Generated electrons are transferred through the conduction band of the semiconductor and are injected directly into the H_2 evolution catalyst. the oxidized dye can in principle be regenerated by a water oxidation catalyst, thus closing the fuel-making cycle (Fig. 1).

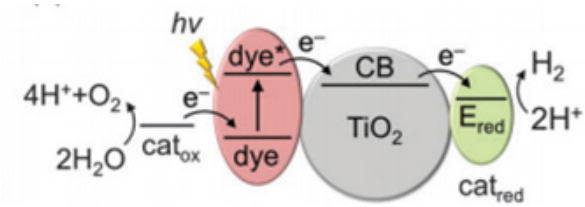

Fig. 1. Schematic representation of dye-sensitised photocatalysis (DSP) for water splitting. cat_{ox} = water oxidation catalyst, cat_{red} = H_2 evolution catalyst [1]

27-3015: Triethylammonium {chlorobis(dimethylglyoximato)(4-hydrogenphosphonatepyridinyl)cobaltate(III)}, also known as a cobaloxime (CoP), is a catalyst that leads to the evolution of H_2 either electro- or photocatalytically in pH-neutral water, even in the presence of atmospheric O_2. The phosphonic acid group in (Et_3NH)[CoP] enables the complex to dissolve in water and allows for its immobilization on metal oxide surfaces for heterogeneous applications [2-4, 6, 9-10].

28-1720: Bis{P,P'-1,5-diphenyl-3,7-bis[(4-hydrogenphosphonate)phenyl]-1,5,3,7-diazadiphosphocine}nickel(II) bromide (hydrogen bromide adduct), also known as Ni bis(diphosphine)(NiP), is an alternative H_2-evolution catalyst. The NiP inner core of the complex is responsible for catalytic activity. The phosphonic acid group in the outer-sphere provides the catalyst with good solubility in aqueous solutions. In addition, the product can be anchored onto semiconductor particles [5-8].

As mentioned, the CoP catalyst shows a tolerance towards O_2, but its activity suffers in the presence of CO. In contrast, the NiP catalyst is strongly inhibited by O_2, but can produce H_2 under high CO concentrations [6].

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27-3015 **Triethylammonium {chlorobis(dimethylglyoximato)(4-hydrogenphosphonatepyridinyl) cobaltate(III)}** 5mg 25mg

CAS# 1280199-86-1

$C_{19}H_{35}ClCoN_6O_7P$; FW: 584.88; light-brown solid

Technical Notes:

1. Synthetic cobaloxime catalyst for reduction of aqueous protons to H_2 in the presence of atmospheric oxygen.
2. Catalysts contains phosphonate anchor groups for immobilisation on metal oxide semiconductor surface enabling light-driven H_2 evolution.

28-1720 **Bis{P,P'-1,5-diphenyl-3,7-bis[(4-hydrogenphosphonate)phenyl]-1,5,3,7-diazadiphosphocine} nickel (II) bromide (hydrogen bromide adduct)** 5mg 25mg

CAS# 1514896-39-9

$C_{60}H_{69}Br_3N_4NiO_{12}P_8$; FW: 1584.41; red-brown xtls.

Technical Notes:

1. Synthetic Ni catalyst for reduction of aqueous protons to H_2.
2. Catalyst tolerates CO.
3. Catalyst contains phosphonate anchor groups for immobilisation on metal oxide semiconductor surface enabling light-driven H_2 evolution.

References:

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