Environment friendly system for the production and safe storage of hydrogen

Background

As the paradigm of environmental awareness is considered at the same level with economic efficiency, the growing energy demand of the population has to be supplied by conscious management of the natural resources, involving sustainable energy production and energy consumption. Air pollution in urban areas carries significant risks for human health and the environment. Hydrogen is a potent candidate to ease the fossil fuel dependency of the society, in a CO_x-emission-free way. Though, the production, safe transportation, storage and efficient use of hydrogen have not been solved perfectly yet.

Technology

The basis for the technology development is a hydrogen storing and generating reaction system developed by the researchers of the University of Debrecen (patenting is in progress). The reaction system is suitable for the storage of hydrogen in a safe aqueous solution of formate (salt of formic acid) and the generation of hydrogen gas without the emission of carbon dioxide or other pollutants. The method bases on the hydrogenation of bicarbonate to formate then the breakdown of formate to bicarbonate in aqueous media. The advantage of the system is that we can get pure hydrogen during this type of the breakdown of formate, which we can use in power generating fuel cells. Our system can be an alternative solution to the safe storage and transportation of hydrogen. It can be used in mobile devices or in the large industrial energy storage sector.

Competitive advantages

- Safe (no explosion risk)
- Environmental friendly
- Using renewable energy sources
- Effective storage of the overproduced energy
- Cheap (formic acid costs about €0.50 / L)

IP status

European and US patents are pending. According to the written opinion of the PCT-authority the invention meets the criteria of patentability.

Related publications

- G. Papp, J. Csorba, G. Laurenczy, F. Joó (2011): A Charge/Discharge Device for Chemical Hydrogen Storage and Generation, Angew. Chem., 50, 10433-10435.
- H. Horváth, G. Papp, R. Szabolcsi, Á. Kathó, F. Joó (2015): Water-Soluble Iridium-NHC-Phosphine Complexes as Catalysts for Chemical Hydrogen Batteries Based on Formate, ChemSusChem, 8, 3036-3038.
- G. Papp, G. Ölveti, H. Horváth, Á. Kathó, F. Joó (2016): Highly efficient dehydrogenation of formic acid in aqueous solution catalysed by an easily available water-soluble iridium(III) dihydride, Dalton Trans. 45, 14516-14519.

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