Titel: Plasma Assisted Hydrogen Production and Plasma Catalytical Oxidation of SO2 and NOX.

Vortragender Autor (Referent) : Dipl.-Ing. Berkant Göksel

Co-Autoren : Prof. Dr. Ing. Ingo Rechenberg

Organisation : Institut für Bionik und Evolutionstechnik, Technische Universität Berlin

Kurzfassung :

This paper shall present an overview about the recent developments in the new research field of plasma assisted hydrogen production from hydrocarbons and water and plasma catalytical oxidation of SO2 and NOx. This field is presently dominated by scientists from MIT (USA) [3] and Kurchatov Institute (Russia) [4]. With the recent acquisition of a new 300 Watt polyphase high-frequency (5-50 kHz) high-voltage (3-6 kV) power supply, the Future Workshop Electrofluidsystems of the Institute of Bionics and Evolutiontechnique will be able to make similar studies especially on plasma assisted hydrogen production from water. The same power supply will be used by the author to develop a new electrostatic wave propulsion by polyphase plasma actuators. The concept for this bionic solution mimicing the flapping wing propulsion of birds and insects was recently submitted to the BMBF concept contest "Bionics – Innovations from Nature" (http://www.bmbf.de/foerderungen/677_7006.php).

To meet future environmental quality goals, the aeroengine company Rolls-Royce Deutschland recently announced that in the time horizont to the year 2020 one major technology task would be the development of plasma catalytical oxidation of SO2 and NOx [1]. And in the time horizont after 2020 the technology task is the development of zero emission vehicles based on fuel cell generators for speculative rotating electrostatic wave "propellers" having no moving parts [1]. For this purpose there is need for onboard plasma assisted hydrogen production from water. From 2000-2003 the author from the Future Workshop Electrofluidsystems was also working for the Future Projects Division of Rolls-Royce Deutschland and assisted the head of the division in defining those now published tasks for the time horizont to and after the year 2020 [1].

The co-author of the paper is studying the catalytic hydrogen production by purple bacterias since 1987. Rechenberg published several reports and papers on hydrogen production by means of artificial bacterial algal symbios [2]. It is the thought of bionics to use artificial systems in place of the evolved originals in nature. In 1996 Rechenberg imagined that hydrogen could be binded to a carbohydrate-analogue in a first stage. The hydrogen-complex, unable to re-act with oxygen, then moves to a second stage, where the hydrogen will be released. The blank carrier molecule moves back to the first state, where it is reloaded with hydrogen [2]. In 1996 Rechenberg wrote that a solution a la bionics is not in sight [2]. But in 2004, the authors say that plasmachemical hydrogen production from hydrocarbons and water could present a promising bionic process based on the same cold plasma technologies studied at the Future Workshop Electrofluidsystems since 1999.

The paper will also present the tasks for an onboard system to convert kerosene to hydrogen rich gas for cleaner, more efficient operation. With a hydrogen-rich gas as an additive to kerosine, large reductions in NOx, a major air pollutant can be obtained. Additionally, SO2 and NOx can be plasma catalytically oxidated by using electron beams and pulsed corona discharges. The principles of the new plasma exhaust aftertreatment technique will be explained.

[1] Rolls-Royce Deutschland (2004) Für den Luftverkehr von Morgen. In Mensch & Technik, VDI/VDE Berlin-Brandenburg-Hamburg-Schleswig-Holstein, I 2004, p. 44-45.

[2] I. Rechenberg (1996) Hydogen Production by Means of Artificial Bacterial Algal Symbios. Proceedings of the 11th World Hydrogen Energy Conference. Stuttgart, Germany 23-28 June 1996, pp 2427-2435. (http://www.bionik.tu-berlin.de/institut/xs2arbas/xs2arbas.html)

[3] L. Bromberg, D.R. Cohn, A. Rabinovich and J. Heywood (2000) Emissions Reductions Using Hydrogen from Plasmatron Fuel Converters. Report PSFC/JA-00-7, Diesel Engine Emission Reduction Workshop, San Diego, CA.

[4] M. Deminsky, V. Jivotov, B. Potapkin, V. Rusanov (2002) Plasma-assisted production of hydrogen from hydrocarbons. Pure Appl. Chem., Vol. 74, No. 3, pp. 413–418.