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(71) Applicant: **HYDROGEN REVOLUTION HUNGARY KFT.** [HU/HU]; Gyár utca 2., 2040 Budaörs (HU).

(72) Inventors: **JOÓ, Ferenc**; Bercsényi Miklós utca 51., 4029 Debrecen (HU). **PAPP, Gábor Csaba**; Arany Sándor utca 16., 4002 Debrecen (HU). **ELEK, János**; Elek utca 166., 4225 Debrecen (HU). **HORVÁTH, Henrietta**; Kossuth utca 42., 4024 Debrecen (HU).

(74) Agent: **GASPARICSNÉ KMETHY, Boglárka**; DANUBIA Patent & Law Office LLC, Bajcsy-Zsilinszky út 16., 1051 Budapest (HU).

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(54) Title: CATALYSTS AND PROCESS FOR HYDROGEN STORAGE BASED ON FORMATE-BICARBONATE EQUILIBRIUM IN AQUEOUS MEDIUM

(57) Abstract: The invention relates to the use of an isolated or non-isolated (*in situ* generated) catalyst comprising an M central metal and at least one strong sigma-donor ligand selected from NHC N-hetero cyclic carbene ligands and Pws water-soluble phosphine ligands in a process for storing hydrogen gas and/or in a process for releasing hydrogen gas, wherein the storage of hydrogen gas and the release of hydrogen gas are based on a formate-bicarbonate equilibrium, wherein M is a metal selected from non-platinum transition metals, p-field metals and f-field metals, NHC is an N-heterocyclic carbene ligand, Pws is a water-soluble phosphine ligand. The invention further relates to a process for a hydrogen gas storage system and a hydrogen gas release system, wherein the storage of hydrogen gas is carried out by hydrogenation of bicarbonates in the presence of the catalyst as described in the specification in an aqueous medium, and the release of hydrogen gas free of CO_x by-products is carried out by decomposition of formates in the presence of the catalyst as described in the specification in an aqueous medium; and wherein preferably the storage of hydrogen gas and the release of hydrogen gas are carried out with the same catalyst in a single system.

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