

R&D activities on hydrogen in Lithuania

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Hydrogen in Lithuania (Industry)



Hydrogen in Lithuania (R&D, more than 40 years experience!!!)





Project "Aluminum in circle economy - from waste through hydrogen energy to alumina" – AliCE-Why (2021-2024 m.)

Hydrogen production as it needed: direct reaction of Al with water





Patent application: PCT/IB2018/052123 (Lithuanian energy institute)

Urbonavicius M., Varnagiris S., Milcius D. Generation of hydrogen by the reaction between plasma modified aluminium and water (doi: 10.1002/ente.201700344)// Energy Technology. ISSN 2194-4288. Vol. 5. No. 12. 2017. p. 2300-2308

M-ERA.NET Project: INNOvative catalyst and its regeneration for clean HYdrogen Production via methane Pyrolysis (*INNOHYPPY; 2023-2025*)





Synthesis of metal hydrides

MgH₂ and Mg₂NiH₄ metal hydrides could be used as a hydrogen source for fuel cell application in mobile devices. The objective of this invention is novel technology for hydrogenation of metals and their alloys which allows avoiding the usage of expensive catalysts such as Pt and Pd.



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Hydrogen generation kinetics via hydrolysis of Mg2Ni and Mg2NiH4 powders



https://doi.org/10.1016/j.ijhydene.2021.08.139

Metal hydrides in synthetic fuel production





 $2Mg_2NiH_{4(s)} + CO_{2(g)} \rightarrow 0.75Mg_2Ni_{(s)} + 2MgO_{(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + C_{(s)} + 4H_{2(g)} + 2MgO_{(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + C_{(s)} + 4H_{2(g)} + 2MgO_{(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + C_{(s)} + 4H_{2(g)} + 2MgO_{(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + C_{(s)} + 4H_{2(g)} + 2MgO_{(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + 0.25Ni_{(s)} + 0.5MgNi_{2(s)} + 0.25Ni_{(s)} +$

 $C_{(s)} + 2H_{2(g)} \rightarrow CH_{4(g)}$



Figure 8. Optical and SEM images: (a) as received Mg₂Ni alloy grains, (b) Mg₂Ni grains after grinding, (c) catalyst–Al₂O₃ mixture after methanation test, and (d) EDS elemental mapping of catalyst–Al₂O₃ mixture after methanation test.

Lelis M. [LEI], Varnagiris Š. [LEI], Urbonavičius M. [LEI], Zakarauskas K. [LEI]. Investigation of Catalyst Development from Mg2NiH4 Hydride and Its Application for the CO2 Methanation Reaction In: Coatings. Basel: MDPI, 2020, vol. 10 (12), 1178, p. 1-15. ISSN 2079-6412.



Large Scale Hydrogen Valley: CROSS-BORDER HYDROGEN VALLEY AROUND THE BALTIC SEA (BALTICSEAH2; 2023 – 2029 ongoing)- Hydrogen Association in Lithuania





M.O: Design, develop, and implement hydrogen Use Cases for the production, storage, distribution, and transmission of hydrogen: starting from 0 and achieving 4,500 tonnes/year of new renewable hydrogen production in the Main Valley by 2024, another 3,000 tonnes by 2025, additional 11,000 tonnes by 2029 and yet an additional 30,000 tonnes by 2030. In total, 48,500 tonnes/year by 2030 in 6 different production Use Cases with dedicated end-use applications in the methanol, ammonia, chemicals, plastics, and refining industries (5) around 34,000 tonnes/year (~70% of the amount of the produced hydrogen).



https://www.lei.lt/en March 2023, Kaunas

