1. <https://nusearch.nottingham.ac.uk/primo-explore/fulldisplay?docid=TN_cdi_crossref_primary_10_1039_C6CP04259G&context=PC&vid=44NOTUK&lang=en_US&search_scope=44NOTUK_COMPLETE&adaptor=primo_central_multiple_fe&tab=44notuk_complete&query=any,contains,Hydrogen%20evolution%20from%20water%20using%20Mo-oxide%20clusters%20in%20the%20gas%20phase:%20DFT%20modeling%20of%20a%20complete%20catalytic%20cycle%20using%20a%20Mo2O4%E2%88%92%2FMo2O5%E2%88%92%20cluster%20couple&offset=0>

R. Manisha, S. Arjun, R. Krishnan, *Physical chemistry chemical physics*, 2016, **18 (36)**, 25687-25692.

Hydrogen evolution from water using Mo-oxide clusters in the gas phase, this is an invaluable piece of research as it allows the production of H2 from a plentiful feedstock using a catalytic cycle, where another species is scarified to be oxidised the article explores which of these sacrificial feedstocks is best, which the H2O is reduced to just H2. Step 1: Mo2O4 + H2O 🡪 Mo2O5 + H2, Step 2: Mo2O5 + X 🡪 Mo2O4 + XO. H2 is the clean fuel of the future is clean production is vital to this revolution. This process can also be used to repurpose waste material as the sacrificial feedstock.

1. <https://nusearch.nottingham.ac.uk/primo-explore/fulldisplay?docid=TN_cdi_gale_infotracacademiconefile_A583361690&context=PC&vid=44NOTUK&lang=en_US&search_scope=44NOTUK_COMPLETE&adaptor=primo_central_multiple_fe&tab=44notuk_complete&query=any,contains,Catalytic%20production%20of%20H2%20using%20transition%20metal%20complexes&offset=0>

P. Wang, G. Liang, C. Boyd, C. Webster, X. Zhao, *European journal of inorganic chemistry,* 2019, **15**, 2134-2139.

Catalytic H2 evolution by a mononuclear Co complex, This article this looking at using water soluble Cobalt complexes {[Co(N4‐Py)(H2O)](PF6)3] where N4-Py = N‐methylpyridine‐2,11‐diaza[3,3](2,6)pyridinophane} as catalysts, where the reactions are driven by light and/or electricity. They did several reactions with different pH’s and in a variety of aqueous solutions to find the best yield. This is a clean method of H2 production which has potential to me scaled for mass production of H2 as it can produce 200 mol of H2 per mol of spent catalyst, making H2 fuel cells far more affordable and realistic as an energy source.

1. <https://nusearch.nottingham.ac.uk/primo-explore/fulldisplay?docid=TN_cdi_crossref_primary_10_1038_nchem_1595&vid=44NOTUK&search_scope=44NOTUK_COMPLETE&tab=44notuk_complete&lang=en_US&context=PC>

R. E. Rodríguez-Lugo, M. Trincado, M. Vogt, F. Tewes, G. Santiso-Quinones, H. Grützmacher, *Nature chemistry*, 2013, **5 (4)**, 342-347

A homogeneous transition metal complex for clean hydrogen production from methanol–water mixtures, looks at using Ruthenium complexes to catalyse the reaction of methanol and water to H2 and CO2 in the same way dehydrogenase would. This means the entirety of the Hydrogen content in the reactants is transformed to H2. A process of this nature would be fantastic for helping to feed the harbour, which uses a vast amount of H2 to produce NH3. One major advantage of this process is it avoids the production of CO gas. It may also lead to the production of methanol fuel cells.

1. <https://www.hydrogeneurope.eu/hydrogen-applications>

Hydrogen Europe, <https://www.hydrogeneurope.eu/hydrogen-applications>, (10/2020).

This source allowed us to appreciate the vast uses of hydrogen and why its production is so important. This will allow the scope of the project to increase while staying on topic of H2 production and uses. This source in great as it has a lot of information on production, storage and uses of H2; while it also remains concise and put the information across in an easily digestible manor. The source is lacking in specific chemical and technical knowledge.

1. <https://nusearch.nottingham.ac.uk/primo-explore/fulldisplay?docid=TN_cdi_ipap_primary_10_7567_JJAP_52_08JH04&context=PC&vid=44NOTUK&lang=en_US&search_scope=44NOTUK_COMPLETE&adaptor=primo_central_multiple_fe&tab=44notuk_complete&query=any,contains,producing%20H2&offset=0>

K. Ohkawa, W. Ohara, D. Uchida, M. Deura, *The Japan Society of Applied Physics*, 2013, **52 (8)**, 08JH04-08JH04-3.

Highly Stable GaN Photocatalyst for Producing H2 Gas from Water, is looking at the use of GaN and a NiO cocatalyst to separate H2O into H2 and O2. This has the advantage over the method using of Mo2O4 as there is no sacrificial feedstock required. While this method will reliably produce H2 continuously it is at a very slow rate; only 184 mL in 500 hrs and an energy efficiency of less than 1%. This is a very promising method but requires additional research into both rate of H2 production and the energy efficiency of the reaction.

1. <https://nusearch.nottingham.ac.uk/primo-explore/fulldisplay?docid=TN_cdi_gale_infotracacademiconefile_A636831632&context=PC&vid=44NOTUK&lang=en_US&search_scope=44NOTUK_COMPLETE&adaptor=primo_central_multiple_fe&tab=44notuk_complete&query=any,contains,Green%20H2%20production&offset=0>

N. Sánchez‐Bastardo, R. Schlögl, H. Ruland, *Chemie ingenieur technik*, 2020, **92 (10)**, 1596-1609

Methane Pyrolysis for CO2‐Free H2 Production: A Green Process to Overcome Renewable Energies Unsteadiness. This article is looking at the use of methane to produce H2 via radical Pyrolysis. As C-H bonds have very strong bond energies traditionally this process must take place at 1100-1200 oC. The use of transition metals such as Ni, Fe and Co can massively reduce the reaction conditions. The transition metals do this by accepting electron density from C-H bonds in methane which induces decomposition of the molecule. The article studies the different reaction conditions required by the three metals and their rates of catalysis. The benefits of this process is it doesn’t produce CO2, but as it uses radicals an array of products could be made, which would result in the products having to be purified.