

H₂ydrogen: Past, Present & Future

Understanding hydrogen and its ability to support our transition to a zero-carbon future is upon us all. The North West of England is playing a pivotal role in reaching this goal, with leading minds from industry and academia engaged in the development of hydrogen production and distribution infrastructure under the HyNet project.

Indeed, the UK's first hydrogen hub is expected to be developed on Merseyside. Essar Oil and Progressive Energy have agreed a joint venture to produce blue hydrogen at the Stanlow Refinery in Ellesmere Port, providing transformational benefits on the region's journey towards Net Zero. With an initial production in 2025 of 3TWh per year of hydrogen, this clean energy is expected to be used to deliver fuel for both domestic and industrial purposes across the North West.

This advanced-thinking has come a long way since this element was first recognised. Here, Axiom's Principal Materials Engineer, Steve Woodward, imparts his thoughts in brief on the subject of hydrogen and its journey through time.

Hydrogen was first produced in the 15th century. However, its discovery is usually attributed to Cavendish in 1776, but it wasn't named 'hydrogen' until 1783, by Lavoisier. The first hydrogen-related component failure was documented in 1875 when it was reported that the fracture surface of an iron wire '*frothed when placed on the tongue*'; the drawn wire having previously been descaled in sulphuric acid.

Despite it being known about for nearly 150 years, hydrogen cracking continues to be one of the most common failure mechanisms. However, the of licking of fracture surfaces is no longer practiced, with fractographic examinations having been superseded now by optical & scanning electron microscopy,

and other more sophisticated metallographic and analysis techniques.

Press articles focus more on 'The Hydrogen Economy' rather than damage mechanisms, describing ways in which hydrogen will save us from ourselves by fuelling everything from cars to ocean liners, whilst at the same time helping us achieve 'Net Zero,' and thus, narrowly avoiding a visit by Keanu Reeves and his robotic accomplice, GORT.

Manufacturing Hydrogen Like There's no Tomorrow!

Our aspirations to rapidly expand the hydrogen economy are evident by the vast swathe of installations across Europe, where you will find projects with appellations that invoke both optimism and sustainability, such as 'Green Octopus' and 'Blue Dolphin.' Obvious by its absence perhaps is a Hindenburg project! This is a poignant reminder that we should pay heed to the hazards involved. As hydrogen usage filters more into the industrial and public domain, greater will be the risk of component failure, fire, explosion, and casualties. Hydrogen is odourless, and burns with an almost invisible flame, so, design, fabrication and transport considerations must be commensurate with these hazards.

Axiom Engineering Associates Ltd possesses in-depth hydrogen sector skills and knowledge and is ideally-placed to advise on mechanical design,

process safety and materials engineering. With additional blue hydrogen production already planned in key Chemical hubs of Teesside, Humberside and Grangemouth, Axiom is ready and able to step up as an experienced industry partner, who can deliver the localised expertise needed to progress these initiatives.

With the production of green hydrogen being the ultimate goal, it is blue hydrogen, the affordable option, that is enabling the world to take a leap forward towards decarbonisation.

Steve Woodward
E: steve.woodward@ax-ea.co.uk

