EuroCorr 2024 - Joint Workshop

(WP5+WP6+WP17+WP22+WP25+WP26+WCO)

Hydrogen Challenges in Energy and Transport Systems

Keywords: Hydrogen Gas, Trapping, Catalysis, Diffusion & Hydrogen Barriers, Effusion, Electrolysers, Fuel Cells, Adsorption-Absorption, Liquid hydrogen (LH), High Pressure Storage, Hydrogen Pipeline, Characterisation and Quantification Techniques, In-situ/Ex-situ Approaches.

The joint workshop **Hydrogen Challenges in Energy and Transport Systems** aims to address all aspects related to hydrogen-material interaction, covering synthesis, storage, distribution, application, detection, characterisation and the usage of hydrogen. This includes development of new structural and functional materials for electrolysers and fuel cells (acid, alkaline, solid-oxide-based), to corrosion and material degradation aspects related to hydrogen production routes (steam reforming, chemical looping), transport, storage and the use of hydrogen in a variety of applications. Aspect related to hydrogen-related fracture and cracking will be addressed in the WP5 session on Environment-Sensitive Fracture.

Our global ambition to achieve net-zero carbon within the next two decades is fuelling the emerging hydrogen sector, resulting in new technologies, rapidly changing energy applications, and even broad front innovation in this field. The implementation of hydrogen in our daily life, however, still poses a **number of grand challenges**. Hydrogen involves the interaction with metallic materials used for construction of membranes in electrolysers, hydrogen treatment units, pipelines and storage vessels. Atomic hydrogen can form by dissociation of gaseous hydrogen molecules that adsorb on metal surfaces or by reduction of hydrogen ions present in water electrolytes in immersion or under atmospheric conditions. These can result in structural integrity challenges, limited efficiency and functionality of electrodes or membranes, as well as reduced longevity or durability of materials. The latter accounts for all industry sectors, including automotive, aerospace, energy, and green technologies.

Hydrogen gas is either synthesised by water electrolysis, via steam reforming, or obtained as by-product in other production cycles, such as chlor-alkali electrolysis, followed by either extended storage at high pressures (350-700 bar), at cryogenic temperatures (liquid hydrogen), or transported over long-distances using pipeline infrastructure and mobile transport vessels. This certainly opens-up research and development opportunities for understanding the durability of existing materials, development of novel, more durable or functional materials, supported by ample modelling and life-time prediction approaches, to even leading innovation in structural health monitoring and the development of novel hydrogen-detection approaches. The use of hydrogen in fuel cells as well as industrial applications, such as CO_2-free steel production, net-zero heating, and electricity generation, plays an important part for the development of our society. Hydrogen is certainly a key technology to assist with the transition to a low carbon energy economy.

The workshop will bring together academia, industry experts, engineers and educate our next generation workforce. We will create a platform for exchange of knowledge and ideas with the goal of identifying issues associated with the interaction of hydrogen with metallic materials.

Focus of this year's session will be on all aspects addressing:

(i) Synthesis/generation of hydrogen, electrodes, efficiency; corrosion
(ii) Mechanisms of atomic hydrogen formation and entry into metal lattices; transport, trapping and de-trapping,
(iii) Material aspects for conversion in different energy sectors,
(iv) Storage tanks, distribution pipeline, vessels,
(v) Aqueous, LH, gaseous hydrogen,
(vi) Catalytic behaviour, diffusion barriers, hydrogen recombination
(vii) Fuel cells, FC membranes,
(viii) Industry needs for further understanding and development of testing and materials.
(ix) Hydrogen - surface interaction: corrosion, surface effects, oxide films, barriers, catalysts

Please submit your abstract before January 31, 2024 via https://eurocorr2024.org/

Co-Chairs: Christine Blanc & Dirk Engelberg (WP 5 Environment Sensitive Fracture), Philippe Marcus (WP6 Surface Science & Corrosion Mechanisms), Elizabeth Szala (WP 17 Corrosion in Automotive), Mikhail Zheludkevich (WP 22 Corrosion Control in Aerospace), Tomáš Prošek (WP 25 Atmospheric Corrosion), Steve Paterson & Marc Wilms (WP26 Corrosion in in Green & Low Carbon Energy Technologies), Gareth Hinds (WCO - President World Corrosion Organization).

Expected duration: 2 days
Expected audience: 100–200 attendees