Ammonia as an Energy Vector

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Abstract:

A hydrogen economy has been the focus of researchers and developers over decades. However, the complexity of moving and storing hydrogen has always been a major obstacle to deploy the concept. Therefore, other materials can be employed to improve handling whilst reducing cost over long distances and long storage periods. Ammonia, a highly hydrogenated molecule, can be used to store and distribute hydrogen easily, as the molecule has been employed for more than 150 years for fertilizer purposes. Being a carbon-free chemical, ammonia (NH3) has the potential to support a hydrogen transition thus decarbonising transport, power and industries. However, the complexity of using ammonia for power generation lays on the appropriate use of the chemical to reach high power outputs combined with currently low efficiencies that bring up overall costs. This complex scenario is also linked to the production of combustion profiles that tend to be highly polluting (with high NOx emissions and slipped unburned ammonia). There is no technology capable of using ammonia whilst producing both low emissions and high efficiencies in large power generation devices, thus efficiently enabling the recovery of hydrogen and reconversion of stranded, green energy that can be fed back to the grid. Tackling these problems can resolve one of the most important barriers in the use of such a molecule and storage of renewable energies. Therefore, this presentation is intended to present state-of-the-art global research that has taken place to understand the combustion features of ammonia blends whilst addressing their application at medium and large power scales. The complexity of nitrogen bounding and its reactivity are discussed with emphasis to tackle NOx emissions. Finally, risks, health and safety, and public perception implications are also presented to provide guidelines for the implementation of facilities to evaluate ammonia for combustion purposes.