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Review

Ammonia and related chemicals as potential indirect hydrogen storage materials

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Abstract

Energy production and combating climate change are among some of the most significant challenges we are facing today. Whilst the introduction of a hydrogen economy has its merits, the associated problems with on-board hydrogen storage are still a barrier to implementation. Ammonia and related chemicals may provide an alternative energy vector. Besides ammonia and metal amine salts, some other ammonia related materials such as hydrazine, ammonia borane, ammonia carbonate and urea also have the potential for use as alternative fuels. These materials conform to many of the US DOE targets for hydrogen storage materials.

Similar to hydrogen, ammonia itself is carbon-free at the end users, although CO_2 emission on production of ammonia is dependent on the source of energy. Both hydrogen and ammonia utilised similar energy sources for production: fossil fuels

hydrogen and ammonia utilised similar energy sources for production: fossil fuels, biomass, renewable electricity, nuclear and solar energy.

While a number of papers have been published on the catalytic decomposition of ammonia or related chemicals to produce hydrogen, the use of fuel cells directly fed by ammonia and related chemicals would have a higher efficiency. In recent years significant progress has been made on direct ammonia, hydrazine and urea fuel cells to generate electricity from these materials for transport applications. With the development and application in these technologies, reduction of CO_2 emissions in transportation would be possible.

In this review, we propose the use of ammonia and related chemicals as potential indirect hydrogen storage materials. The progress on fuel cells using these fuels is also briefly reviewed.

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Keywords

Ammonia; Ammonium carbonate; Urea; Hydrazine; Hydrogen storage; Fuel cell

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