# Hydrogen Storage Materials for Renewable Energy Uptake

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The increase in the world population and the progress of science and technology cause fossil fuel depletion and global warming. In addition air pollution by PM2.5 released from the combustion of fossil fuels also causes serious health damage. $CO_2$-free society has been expected to utilize renewable energy with high efficiency. Although renewable energy is used by converting it into an electric energy, the electric energy fluctuates in time and space. Hydrogen is produced by electrolysis of water and has been considered as a secondary energy that is clean and can be stored and transported for globally leveling of the renewable energy. Unfortunately, hydrogen is a gas at room temperature and has poor volumetric energy density. Hydrogen storage technology is essentially necessary to realize $CO_2$-free society. Hydrogen can be stored as a hydrogen-absorbing alloy, as metal hydrides with light elements, as organic hydrides or by adsorption on carbon materials.

Among hydrogen storage materials, ammonia has a highest volumetric hydrogen density of 10.7 kg$H_2$/100L, because it is easily liquefied by compression at 1 MPa and 298K. The volumetric hydrogen density is above 1.5 times of liquid hydrogen. Moreover it has a high gravimetric hydrogen density of 17.8 wt%. However, ammonia is a deleterious substance. Ammonia removal system combined water and insoluble proton-based materials will be candidate to suppress the leaked ammonia concentration. Therefore, ammonia will be applied for hydrogen and energy carriers for global levelling of renewable energy.

It is difficult to store and transport a large amount of electricity using secondary batteries, although energy conversion efficiency from renewable electricity to the battery is about two times compared with the efficiency from renewable electricity to ammonia. Then the secondary battery will be used for local levelling of renewable energy (Figure 1).

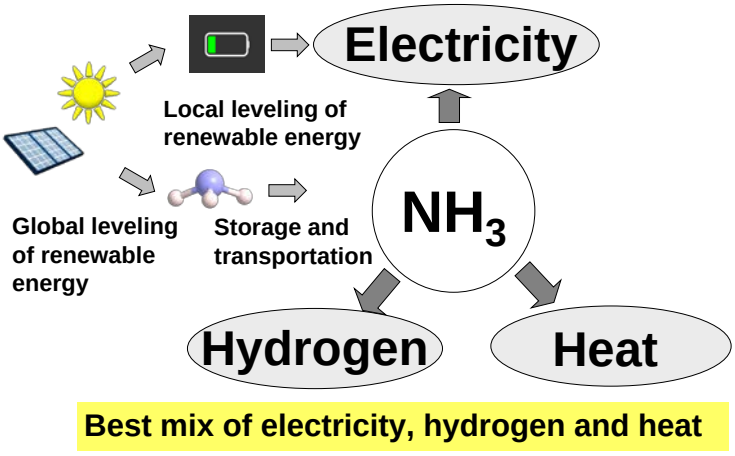


Figure 1. Realization of $CO_2$-free society