ESN-HP-P016

# Development of hydrogen production device from ammonia using pulsed plasma technique

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Ammonia is one of hydrogen storage material, which may solve problems of hydrogen transportation and storages in hydrogen economy. As an original hydrogen production, pulsed plasma decomposition has been examined. It found that molecular ammonia was rapidly decomposed by electron energy in plasma, which was converted to molecular hydrogen. Hydrogen production rate was affected by ammonia flow rates, ammonia concentrations, applied voltages, and repetition rates. The reaction mechanism of hydrogen production in plasma was studied by elemental reaction simulation.

A schematic diagram of the experimental apparatus for hydrogen production is shown in Figure 1. The electrodes are coaxial in configuration, with quartz glass tubes as the dielectric materials.

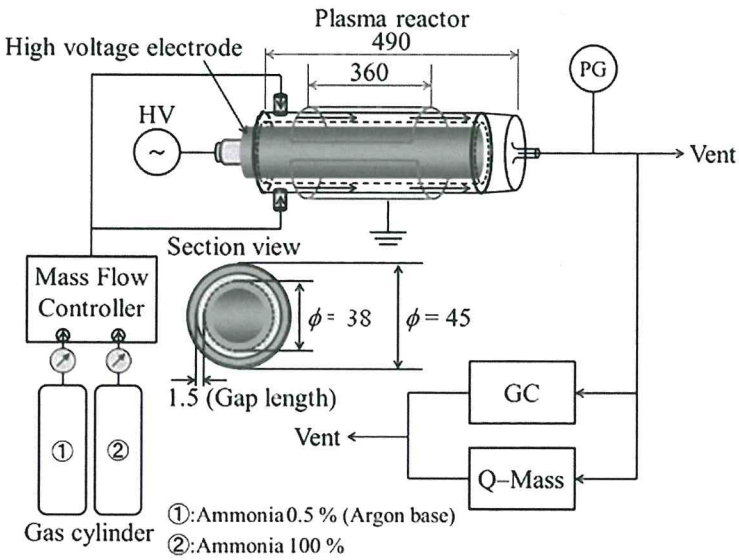


Figure 1: Experimental setup for hydrogen production using pulsed plasma.

Figure 2 shows $NH_3$ decomposition as a function of the applied voltage ($V_{pp}$) at a repetition rate of 10 kHz for gas flow rates from 0.2 to 0.8 L/min. $NH_3$ decomposition generally increases with increasing $V_{pp}$ at all gas flow rates. In plasma processing, electron-impact dissociation of molecular ammonia produces $NH_i$ ($NH_2$, NH, and N) and H radicals. The concentrations of these radicals are a function of the electron mean energy, which depends on $V_{pp}$. An increase in the concentrations of $NH_i$ and H radicals facilitates hydrogen production in the gas phase reactions. Approximately 100% decomposition of ammonia was attained at a flow rate of 0.2 L/min at applied voltage of 15 kV.

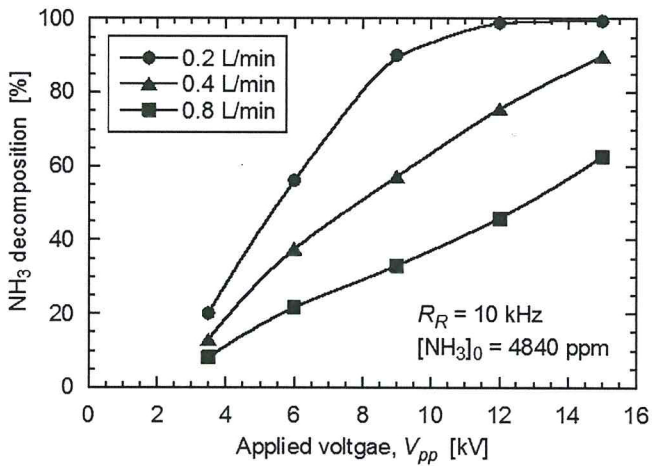


Figure 2: Effect of $V_{pp}$ and flow rates on $NH_3$ decomposition.