Ammonia decomposition by microwave plasma discharges

M. Y. Awaji, L. Pentecoste*, C. Noel, M. Belmahi, T. Gries, T. Belmonte

Université de Lorraine, CNRS, IJL, F-54000 Nancy, France
*lucile.pentecoste-cuynet@univ-lorraine.fr

Ammonia is a promising energy vector as it is much easier to store and transport than hydrogen. It benefits from large infrastructures already available worldwide and about 20 million metric tons of NH₃ are traded every year for a year production of 150 million tons. If many works focus on the production of ammonia by electrical discharges [1], only a few are devoted to the cracking of ammonia and mostly focus on catalysis [2].

In this work, we propose to study the decomposition of ammonia by microwave (MW) plasma. A MW cavity, that confines an electromagnetic field excited at 2.45 GHz, is used to ignite an electrodeless plasma in a fused silica tube. NH₃ and NH₃:N₂ mixtures are partially ionized. The plasma is characterized by optical emission spectrometry in order to determine the various light emitting species produced and plasma parameters such as rotational and vibrational temperatures of some species. The trend of dissociation yield of ammonia has been determined by in-situ FTIR as a function of experimental parameters [3]. Further analysis of the reactor effluents by gas chromatography completes the study of the process efficiency.

The influence of the input power at near atmospheric pressure and flowrate will be discussed as they are key parameters to evaluate the process yield. It must be compared with thermal processes with or without catalysts such as ruthenium which are the most efficient methods to crack ammonia known to date.

Acknowledgements
The authors would like to express their gratitude to the Department of Physics, College of Science, Jazan University, Jazan 45142, Saudi Arabia, for the financial support to M. Awaji, and to SAKOWIN for the financial support to L. Pentecoste.

Références

Statut : doc3, postdoc