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Electrochemical conversion of dinitrogen to ammonia induced by a metal complex–supported ionic liquid

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An ionic liquid, which is a salt in a liquid state under ambient conditions, has recently been employed in a number of different research fields, because it has several unique properties such as low volatility, large electrochemical window, high thermal and chemical stabilities, and high electric conductivity. The reduction of small molecule, such as CO_2, O_2, in ionic liquid has been researched because the reactivity is different from that in conventional organic solvents. On the other hand, the reduction of N_2 in ionic liquid has never been reported. We have reported the first example of the electrochemical reduction of N_2 to NH_3 using the W E coated with Cp_2TiCl_2–supported ionic liquid under ambient conditions. In this study, we used the ionic liquid, 1–butyl–1–methylpyrrolidinium tris (pentafluoroethyl) trifluoro–phosphate ($[C_9H_{20}N]^+[(C_2F_5)_3PF_3]^-$), which is appropriate for use as a supporting material, because of its high chemical stability. When the controlled potential electrolysis was carried out at -1.5 V (vs. Ag/AgCl), the yield of NH_3 per Cp_2TiCl_2 and current efficiency were 27% and 0.2%, respectively, which are significantly higher in comparison with those reported previously. In this paper, we will report the controlled potential electrolysis by Cp_2TiCl_2- supported $[C_9H_{20}N]^+$ $[(C_2F_5)_3PF_3]^-$ under other experimental conditions.

Biography

Akira Katayama is a PhD course student from H Masuda's group of Nagoya Institute of Technology and is a JSPS Research fellow (DC2). He received Master of Engineering and Bachelor of Engineering from the same institute.

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