Supporting Information

Elucidation of the behavior of oxygen remaining in water molecules after hydrogen atom abstraction in the Plasma/Liquid (P/L) interfacial reaction: Improvement in the selectivity of ammonia synthesis and parallel production of hydrogen gas

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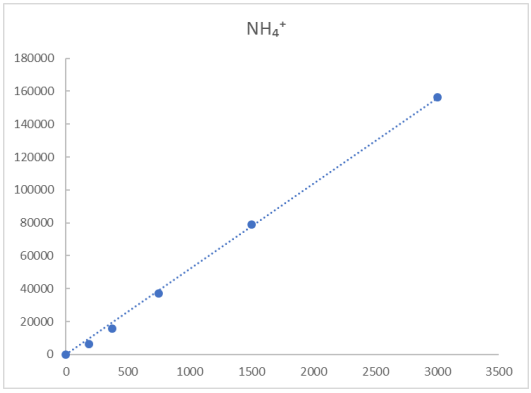
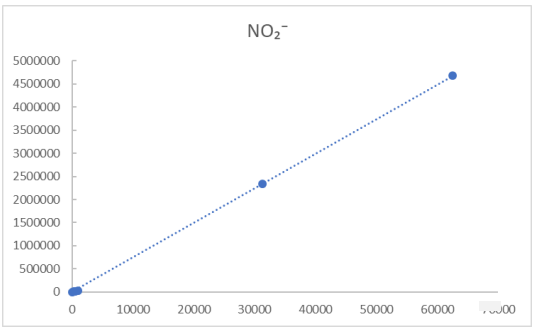
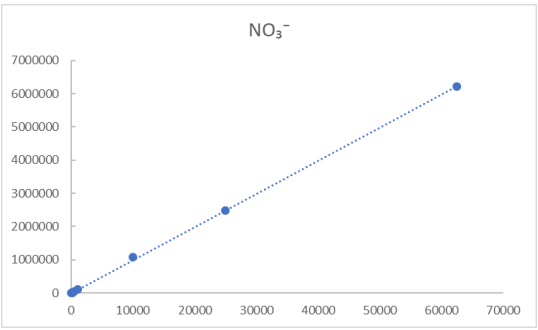


(a)



(b)



(c)

Figure S1. Calibration curve and calibration curve precision using standard sample for ammonium, nitrate, and nitrite ions in ion chromatography analysis. Correlation coefficient (R): ammonium ion (NH_4^+) R = 0.9998, nitrite ion (NO_2^-) R = 0.9999, nitrate ion (NO_3^-) R = 0.9998.

Standard chemicals:

All standard chemicals were purchased from Wako Chemicals Co., Ltd.

Ammonium ion (NH_4^+): Ammonium ion standard solution (NH_4NO_3 (aq.))

Nitrate ion (NO_3^-): Nitrate ion standard solution ($NaNO_2$ (aq.))

Nitrite ion (NO_2^-): Nitrate ion standard solution ($NaNO_3$ (aq.))

Analysis conditions

Cation chromatography

Eluent: 3.0 mM methanesulfonic acid (aq.)

Flow rate: 1.9 mL/min

Column temperature: 40 °C

Anion chromatography

Eluent: 3.6 mM sodium carbonate (aq.)

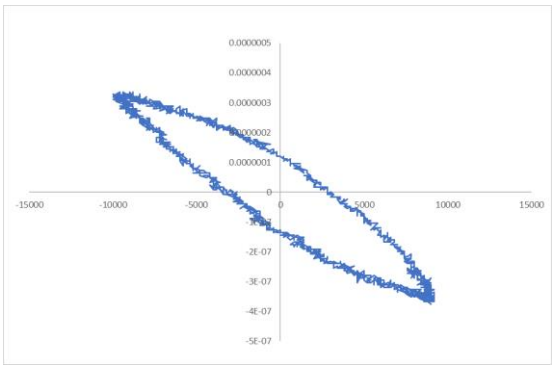
Flow rate: 0.8 mL/min

Column temperature: 45 °C

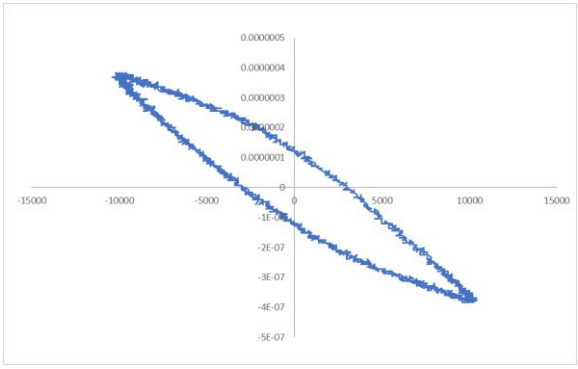
Table S1. Measurement ranges of NH_3, NO, and NO_2 using a Kitagawa type detector tube.

Gas composition	Measuring range (ppm)
NH_3	0.2 - 20
NO	10 - 300
NO_2	1 - 40

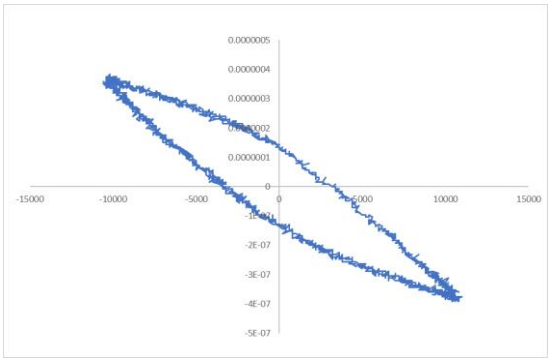
(a) DBD discharge



(b) PbDBD discharge filled with glass beads



(c) PbDBD discharge filled with alumina beads



(d) PbDBD discharge filled with titania beads

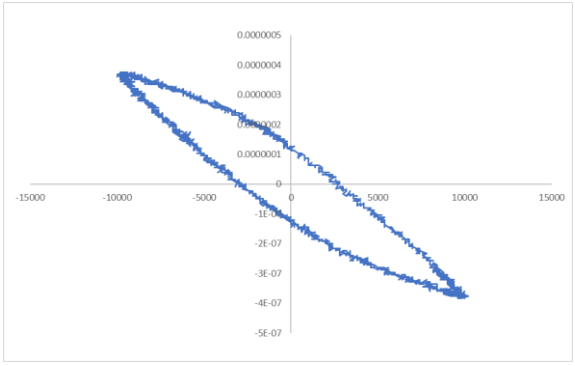
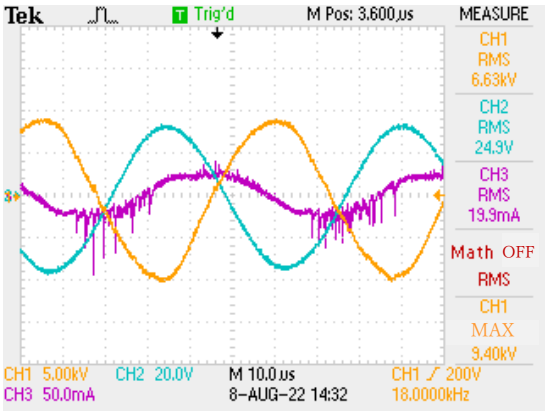


Figure S2. The electric power required for (a) a DBD discharge and PbDBD discharge filled with, (b) glass, (c) alumina, and (d) with titania beads to activate nitrogen was determined by preparing Lissajous curves.

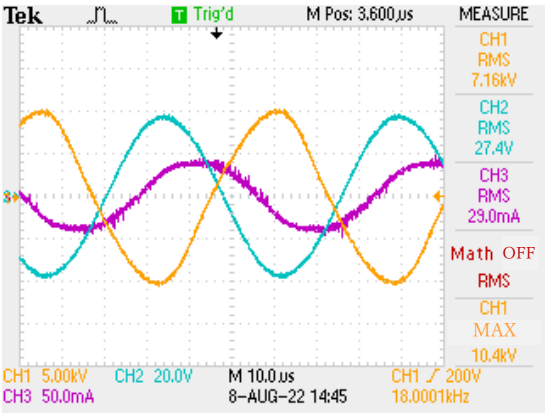
Table S2. Electric power equipments.

	Electric power [W]
DBD discharge	52.22
PbDBD discharge filled with glass beads	53.14
PbDBD discharge filled with alumina beads	56.61
PbDBD discharge filled with titania beads	52.71

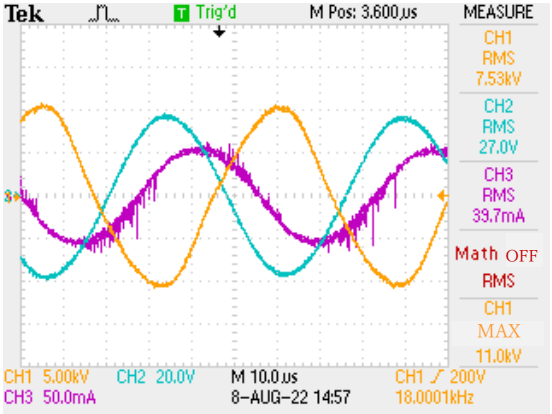
(a) DBD discharge



(b) PbDBD discharge filled with glass beads



(c) PbDBD discharge filled with alumina beads



(d) PbDBD discharge filled with titania beads

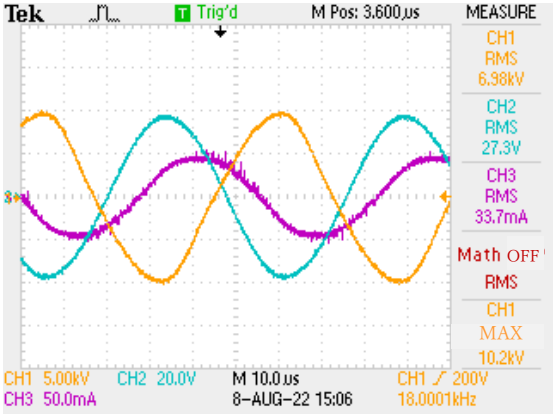


Figure S3. Waveforms obtained using an oscilloscope. CH1: voltage of the reactor, CH2: voltage of the capacitor, and CN3: current of the entire circuit. (a) DBD discharge and PbDBD discharge filled with (b) glass, (c) alumina, and (d) titania beads.