Supporting Information

Efficient Hydrogen Production by Direct Electrolysis of Waste Biomass at Intermediate Temperatures

Takashi Hibino [*] [†], *Kazuyo Kobayashi* [†], *Masaya Ito* [†], *Qiang Ma* [†], *Masahiro Nagao* [†], *Mai Fukui* [‡], *Shinya Teranishi* [‡]

[*]Corresponding author email: hibino@urban.env.nagoya-u.ac.jp

[†] Graduate School of Environmental Studies, Nagoya University, Nagoya 464-8601, Japan

[‡] Soken Inc., 500-20, Minamiyama, Komenogi-cho, Nisshin, Aichi 470-0111, Japan

The Supporting Information includes additional information and figures.

Number of Pages: 6

Number of Figures: 3

Table of Contents

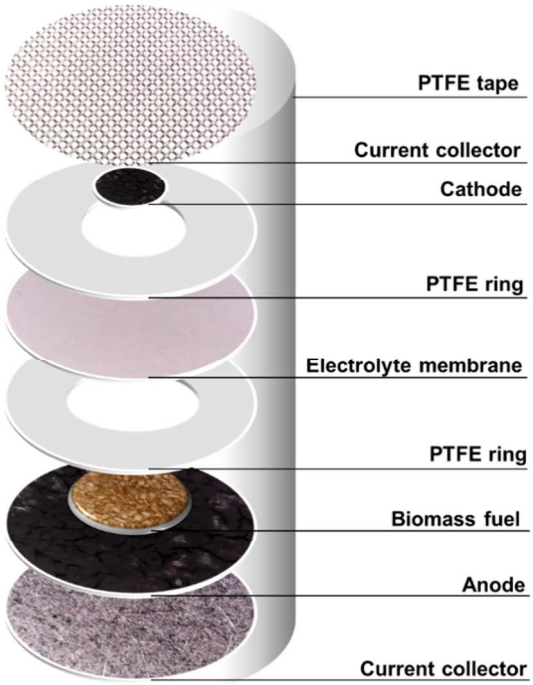
Calculation of H_2, CO_2 and NO_2 formation rates

The hydrogen, CO_2, and NO_2 formation rates were calculated as follows. Based on Reactions (2) and (4), hydrogen and CO_2 or NO_2 are assumed to be formed by two- and four-electron reactions, respectively: the number of electrons (z) transferred per H_2 molecule in Reaction (2) is 2; z transferred per CO_2 or NO_2 molecule in Reaction (4) is 4. For electrolysis with a constant current (I), the mole number (n) of hydrogen, CO_2 or NO_2 produced per minute is estimated as:

$$n = (IA \times 60\ s)/(z \times 96485\ C)$$

The current efficiency was estimated as a percentage of the actual rate to the theoretical value.

a)



b)

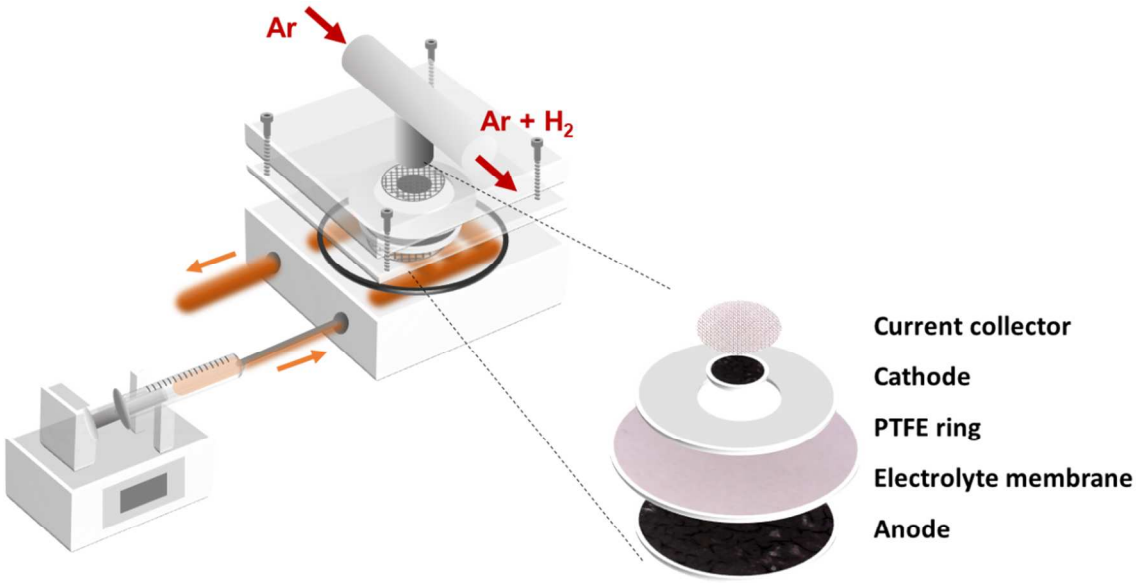


Figure S1. Illustrations of electrolysis cells: a) batch and b) flow type cells.

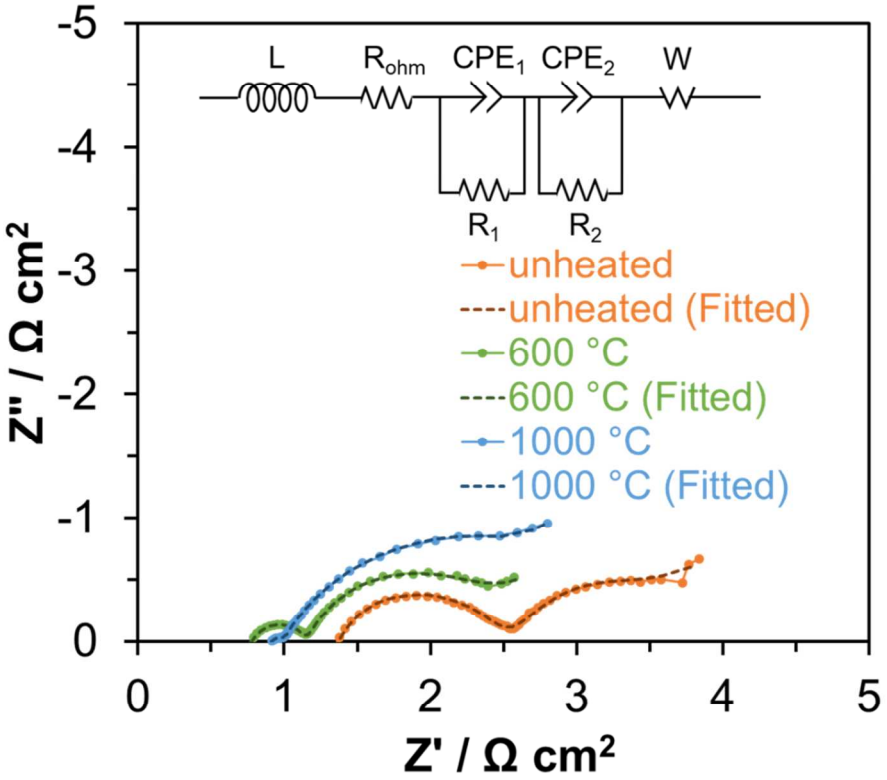


Figure S2. Impedance spectra for the cells at 150°C using the unheated KB anode, and the KB anodes heated at 600 and 1000 °C, and their curve fitting results.

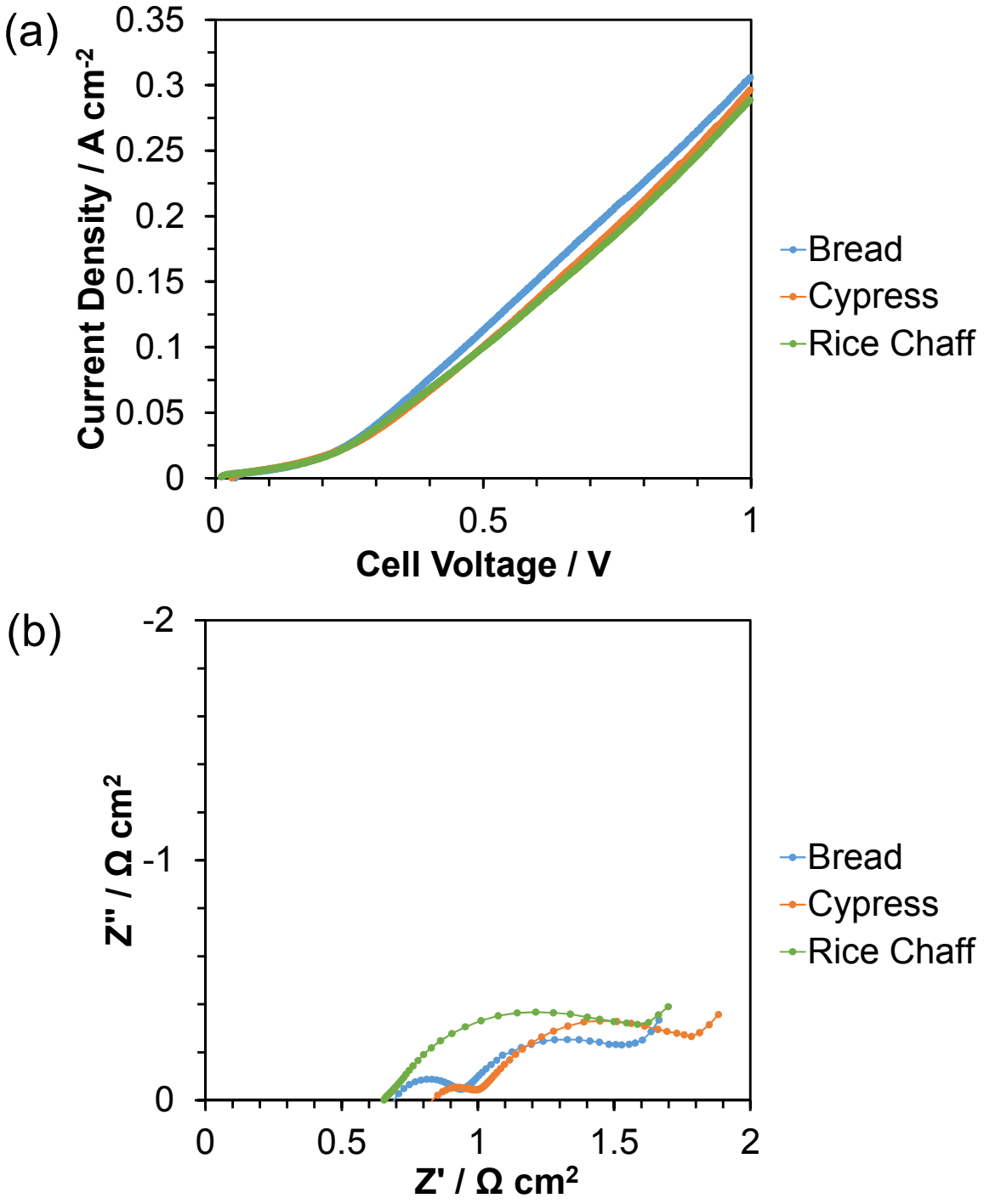


Figure S3. Electrolysis characteristics of the batch cell using the bread, cypress, and rice chaff fuels at 150°C: (a) *I-V* curves and (b) impedance spectra.