Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting Information for

Electrochemical reduction of CO_2 using palladium modified boron-doped diamond electrodes: enhancing the production of CO

Prastika K. Jiwanti[a], Yasuaki Einaga*[,a,b]

[a]*Department of Chemistry, Keio University, 3-14-1 Hiyoshi, Yokohama 223-8522, Japan*

[b]*ACCEL, Japan Science and Technology Agency, 5-3 Yonbancho, Chiyoda 102-8666, Japan*

*Corresponding author
Email: einaga@chem.keio.ac.jp

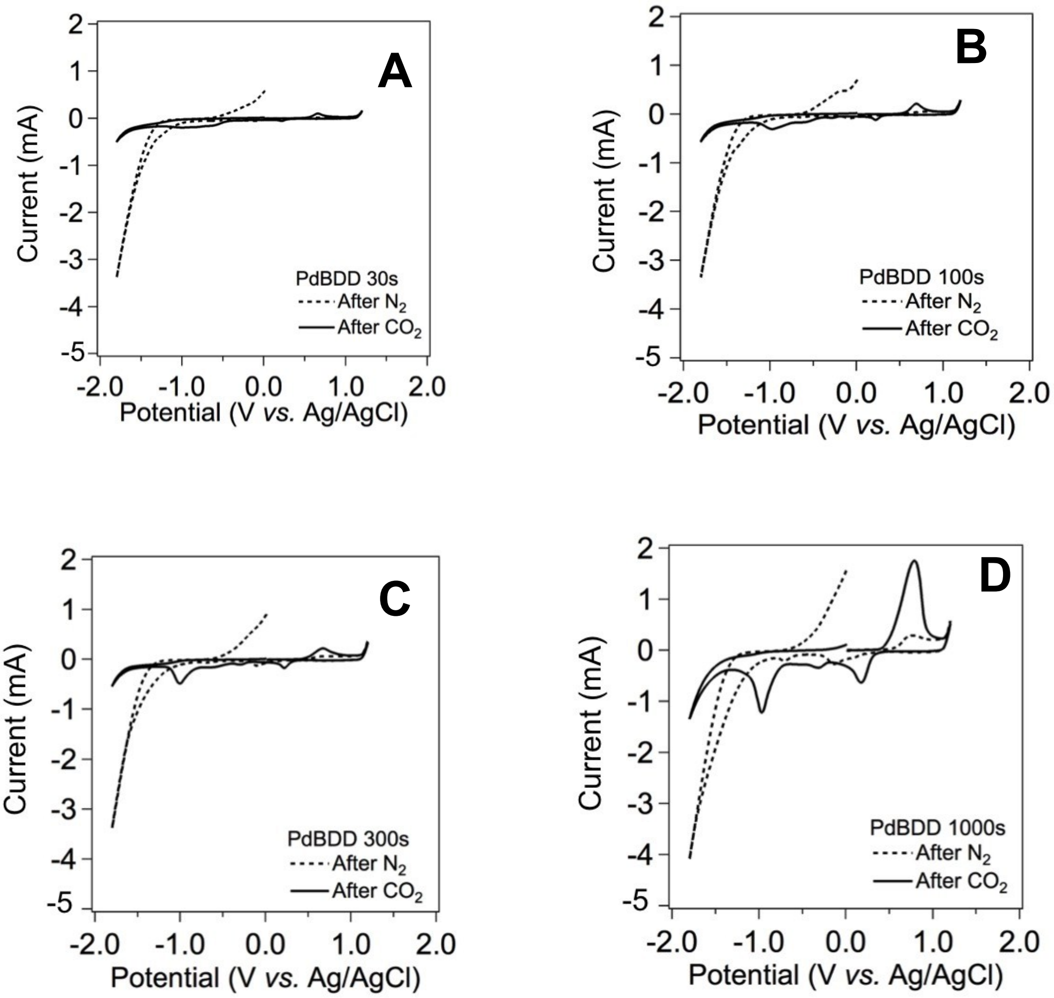


Figure S1. CVs of PdBDD30 (A), PdBDD100 (B), PdBDD300 (C), and PdBDD1000 (D) after N_2 and CO_2 bubbling, performed in 0.1 M NaCl with a scan rate of 100 mV/s, and potentials ranging from -1.8 V to 1.2 V.

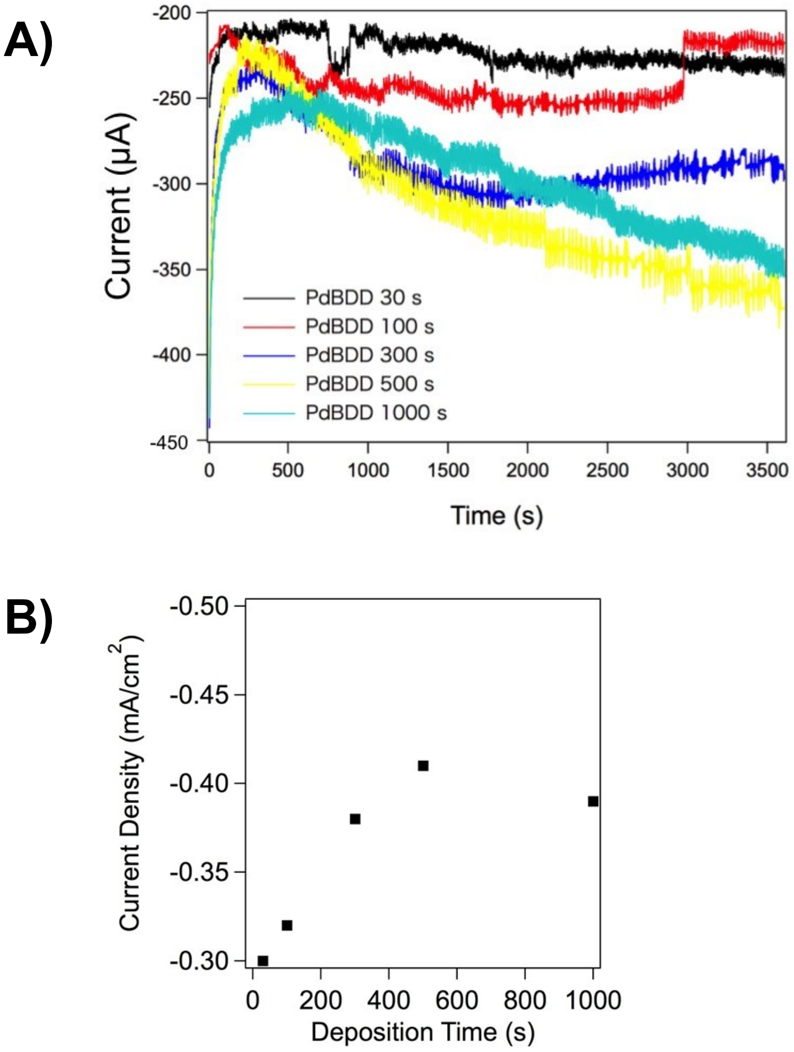


Figure S2. Chronoamperometry for the electrochemical reduction of CO_2 (A) and the current density at a potential of -1.5 V (B) using PdBDD electrodes with different Pd deposition time.

Table S1. Faradaic efficiencies for the products produced using bare BDD and Pd metal electrodes

Electrode	Potential/V	Faradaic Efficiency/%		
		HCOOH	CO	H_2
Bare BDD	-1.6	5.76	9.95	84.92
Pd metal*	-1.6	0.70	9.34	8.53

*The total faradaic efficiency of the products with the Pd metal electrode is far from 100%. This might be due to dissolution of H_2 into the electrode [1].

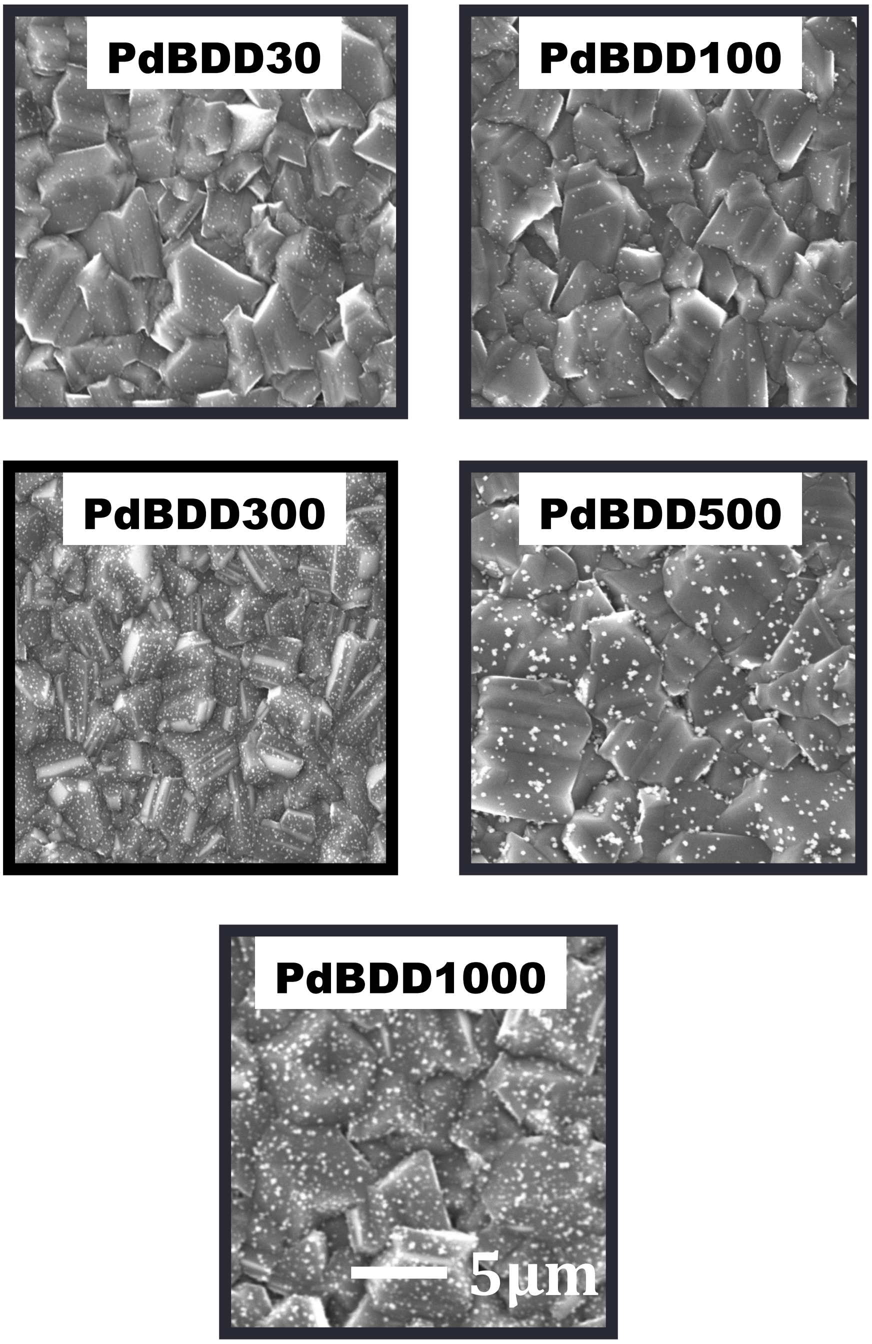
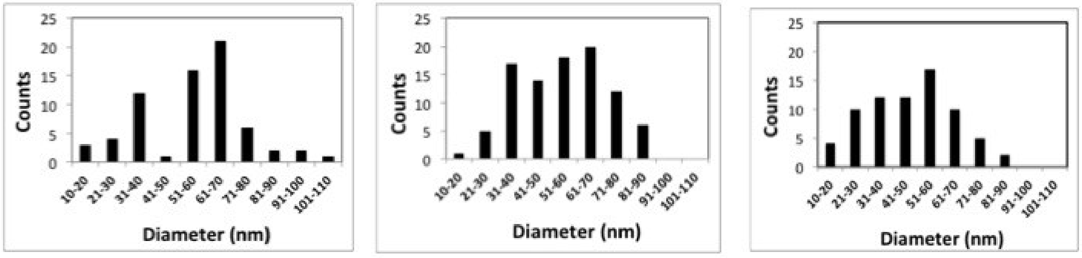


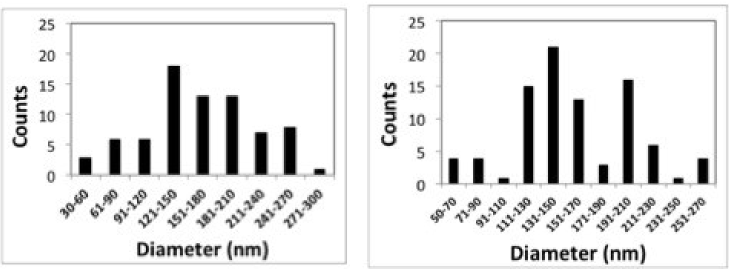
Figure S3. SEM images of PdBDD electrodes after the electrochemical reduction of CO_2 at a potential of -1.5 V for 1 hour.



PdBDD30
Mean: 55.02 nm

PdBDD100
Mean: 55.21 nm

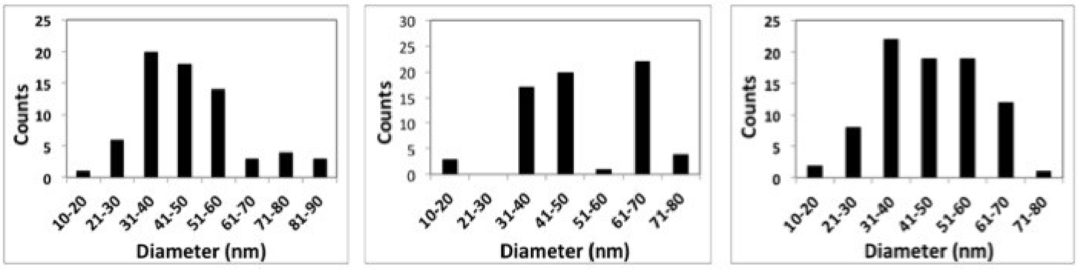
PdBDD300
Mean: 47.13 nm



PdBDD500
Mean: 160.36 nm

PdBDD1000
Mean: 156.65 nm

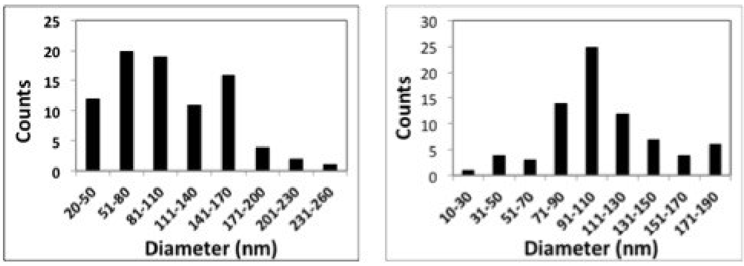
Figure S4. Pd particle size distribution after electrochemical deposition at a potential of -0.15 V using electrodes with different deposition times



PdBDD30
Mean: 46.64 nm

PdBDD100
Mean: 48.85 nm

PdBDD100
Mean: 45.25 nm



PdBDD500
Mean: 104.19 nm

PdBDD1000
Mean: 107.74 nm

Figure S5. Pd particle size distribution on the different PdBDD electrodes, after electrochemical reduction of CO_2 at a potential of -1.5 V for 1 hour.

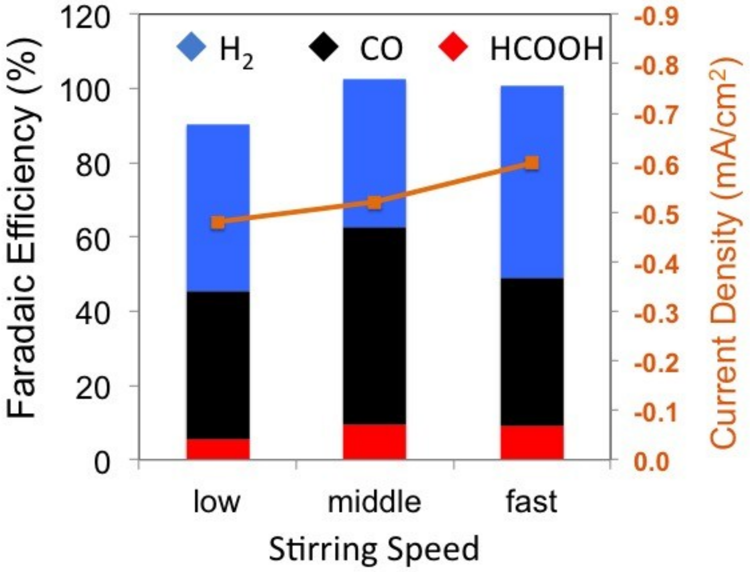


Figure S6. Stirring speed dependence of the faradaic efficiencies of the products and the current density during the electrochemical reduction of CO_2 carried out using PdBDD300 at a potential of -1.6 V for 1 hour.

Reference

[1] Y. Hori, H. Wakebe, T. Tsukamoto, O. Koga, *Electrochem. Commun.* **1994**, *39*, 1833–1839.