

Supporting Information

Uniformity, Performance, and Durability of Roll-to-Roll-Coated Iridium Oxide Electrolyzer Catalyst Layers

Scott A. Mauger,^{1*} Sanghun Lee,^{1,a} Robin Rice,¹ Elliot Padgett,¹ Sarah Zaccarine,^{2,b} Maryam Ahmadi,³ Mariah Batool,³ Kimberly S. Reeves,⁴ David A. Cullen,⁴ Svitlana Pylypenko,² Jasna Jankovic,³ Michael Ulsh¹

- 1) National Laboratory of the Rockies, Golden, Colorado, USA
- 2) Department of Chemistry, Colorado School of Mines, Golden, Colorado, USA
- 3) Center for Clean Energy Engineering, Institute of Materials Science, and Materials Science and Engineering Department, University of Connecticut, Storrs, CT, USA.
- 4) Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, TN, 37831, USA

Current addresses

- a. Department of Climate and Energy Systems Engineering, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul, 03760, Republic of Korea
- b. Physical Electronics, Chanhassen, Minnesota, USA

Corresponding author, e-mail address: scott.mauger@nrel.gov



Figure S1. Photograph of the roll-to-roll coating system used in this study.

Table S1. Specification of gravure cylinders used in this study.

Mesh Size (lines/inch)	Volume Factor (cm³/m²)	Wet Thickness Range (μm)
25	170	50 – 80
30	150	30 – 45
38	131	25 – 40
60	105	21 – 31
80	67	12 – 20
120	31	5 – 11
150	24	4 – 9

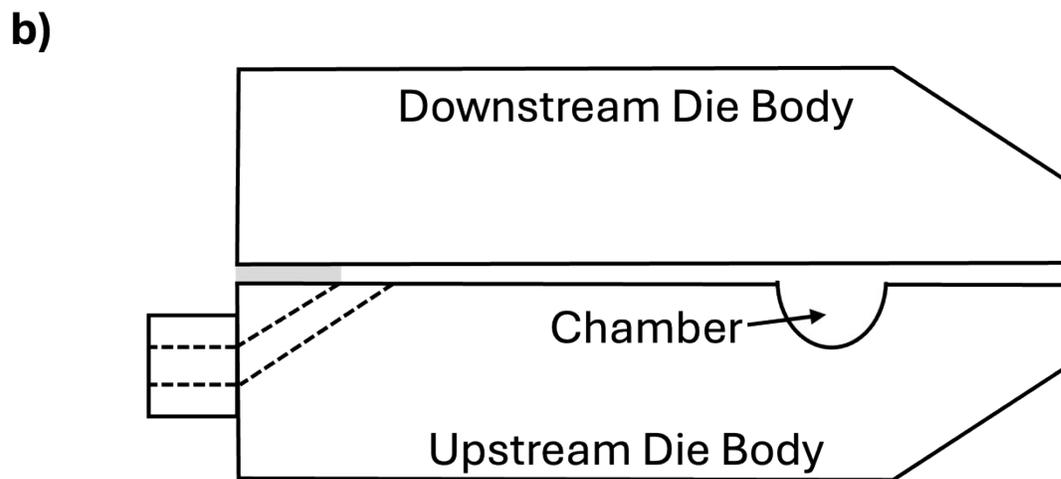
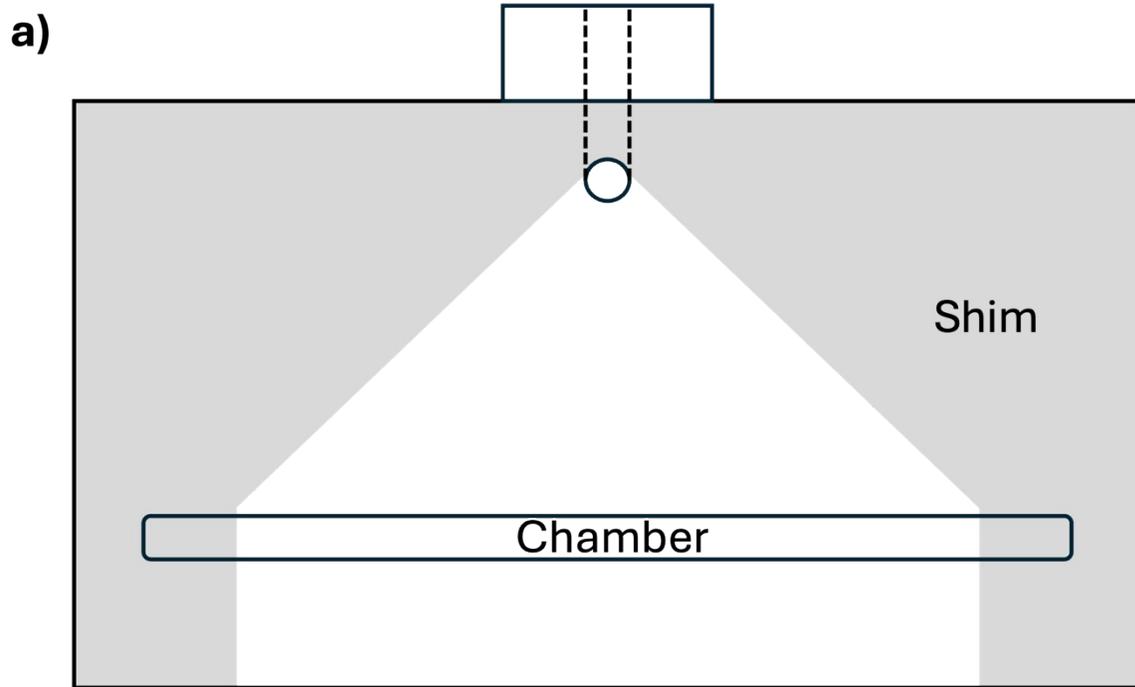


Figure S2. Schematic of the slot die used in this study. a) Top-down view of the upstream die body with shim. b) Cross-sectional side view of the die. Dimensions not to scale.

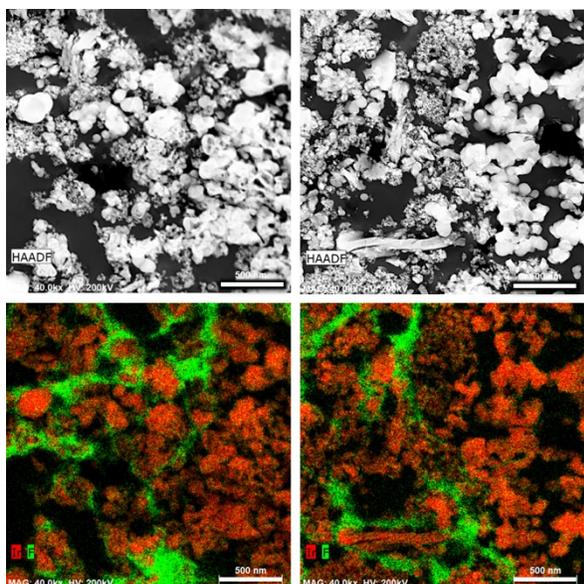


Figure S3. HAADF images (top row) and EDS maps (bottom row) of gravure layer (left column) and slot die layer (right column) for 30 wt% IrO₂ samples. Scale is bar 500 nm.

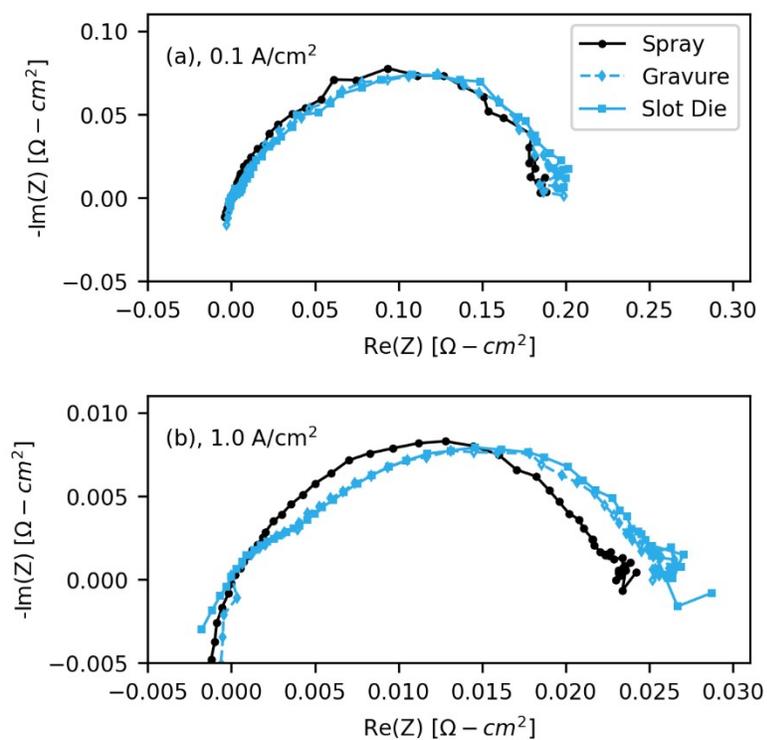


Figure S4. Electrochemical impedance spectra measured for the MEAs presented in Figure 6. Spectra presented were measured at current densities of (a) 0.1 and (b) 1.0 A/cm².

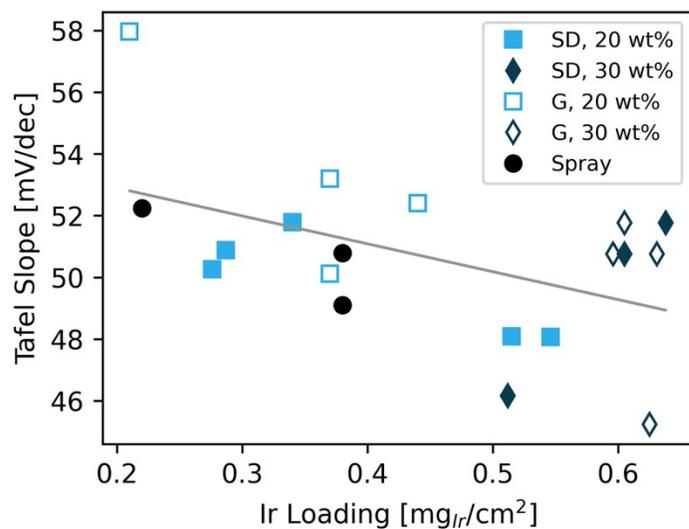


Figure S5. Plot of Tafel slope as a function of MEA loading. Blue symbols are the fitted Tafel slope for an individual MEA. The black line is the linear regression fit to the Tafel slope data. The slope of the linear regression is $-9.0 \text{ (mV/dec)/(mg}_{Ir}/\text{cm}^2)$. Legend: SD – slot die and G – gravure.

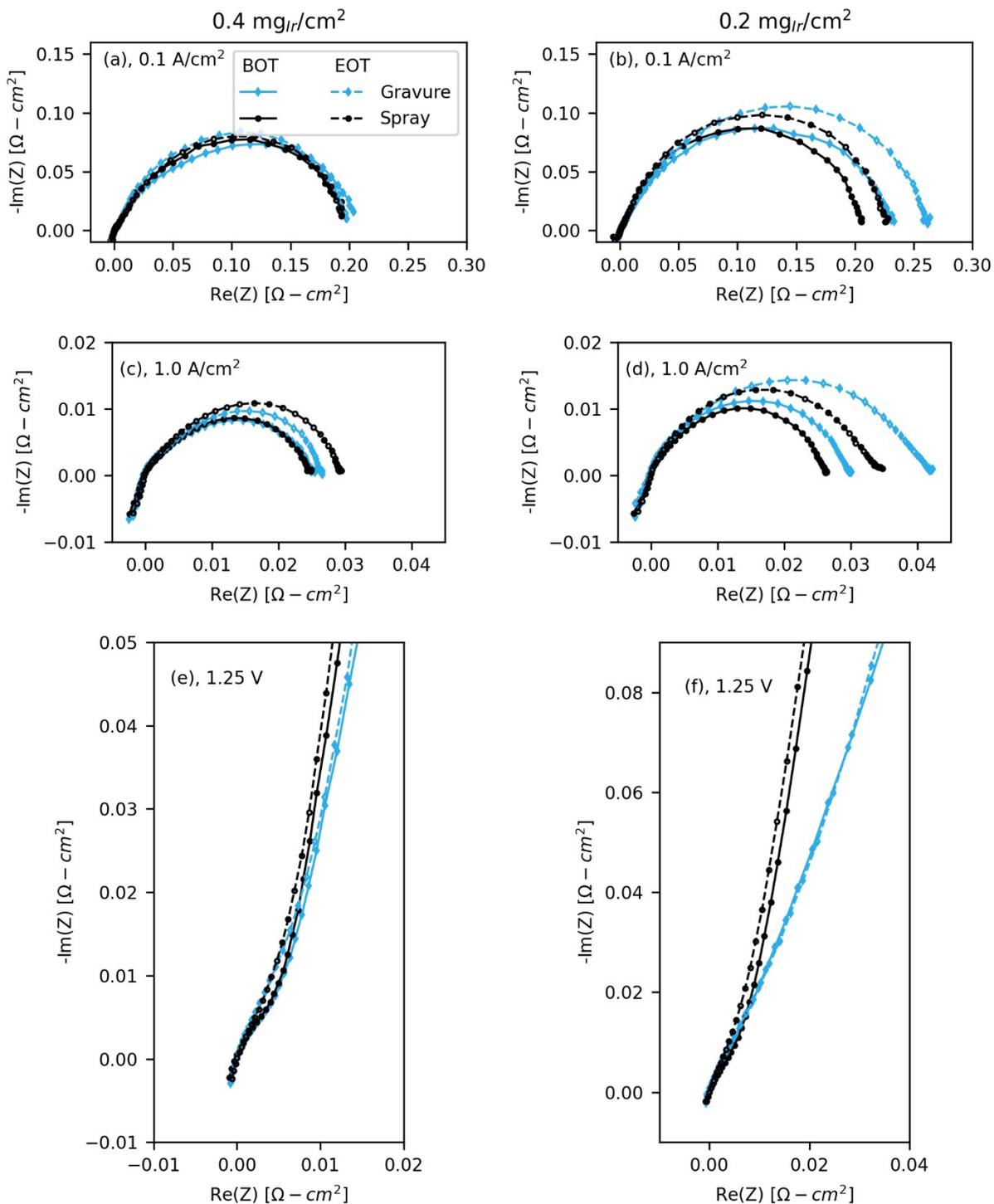


Figure S6. Electrochemical impedance spectra measured for spray-coated and gravure-coated MEAs whose polarization curves were presented in Figure 8. The left column of plots (a, c, and e) is for anode catalyst layer loadings of $0.4 \text{ mgIr}/\text{cm}^2$. The right column of plots (b, d, and f) is for anode catalyst layer loadings of $0.2 \text{ mgIr}/\text{cm}^2$. Data in plots (a) – (d) were measured during acquisition of polarization curves. The non-Faradaic spectra in (e) and (f) were measured at 1.25 V . For all plots the real impedance has been corrected by subtracting the real impedance value when the imaginary impedance is zero.

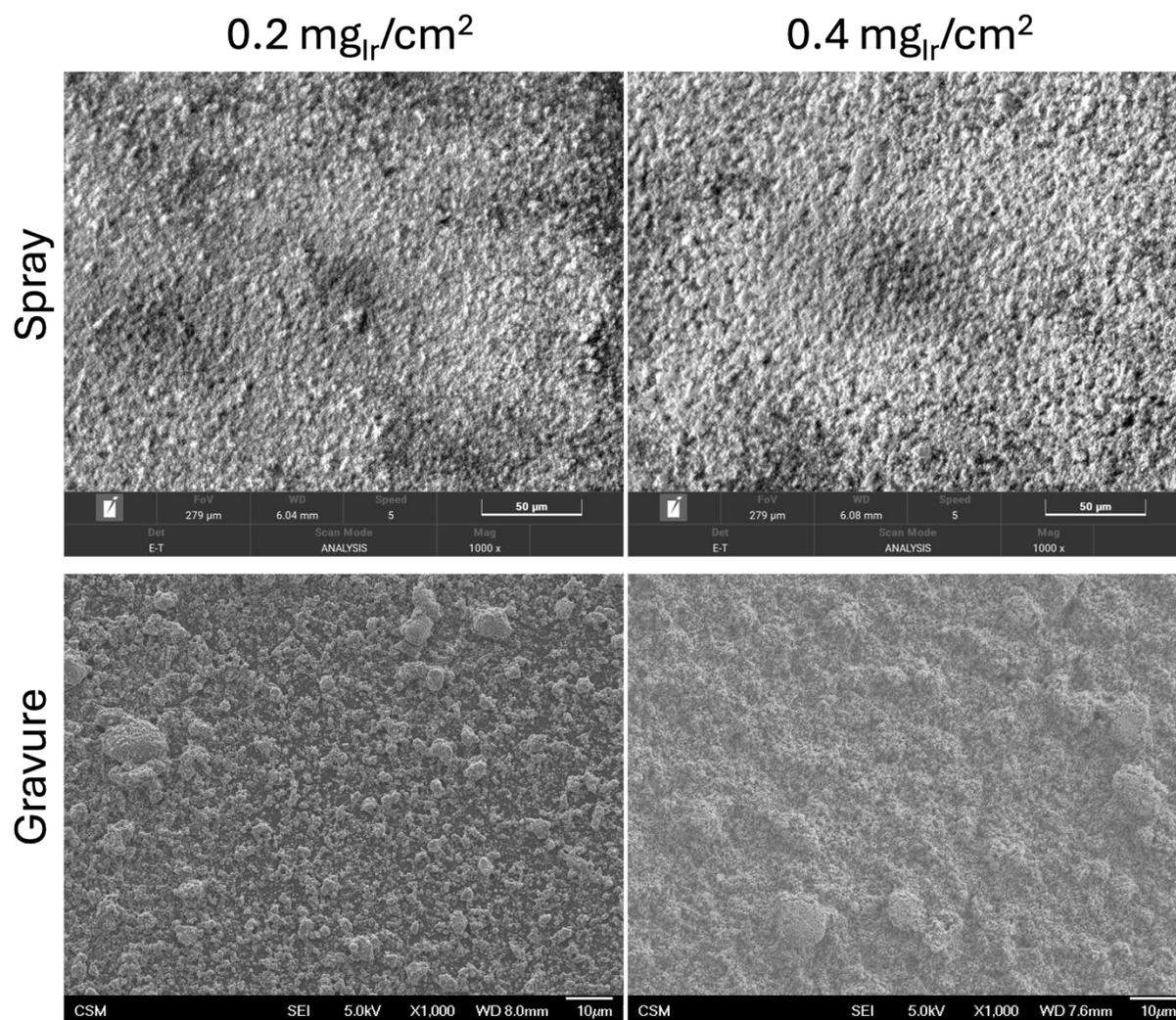


Figure S7. Scanning electron microscopy images of spray coated catalyst layers (top) and gravure coated catalyst layers (bottom) with Ir loadings of roughly 0.2 and 0.4 mg_{Ir}/cm²