

Room Temperature Nanographene Production via CO₂ Electrochemical Reduction on the Electrodeposited Bi on Sn Substrate

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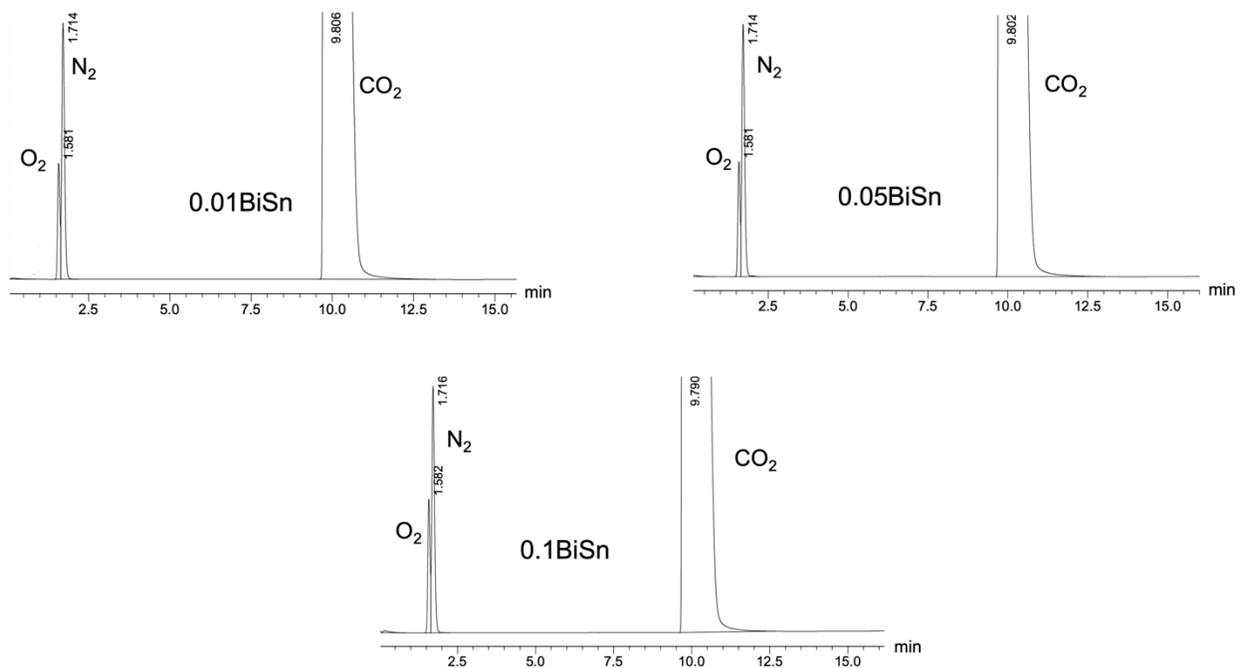


Figure S1 GC-TCD results of 0.01Bi/Sn, 0.05Bi/Sn, and 0.1Bi/Sn after CO₂RR at -1.1 V vs. Ag/AgCl for 70 min

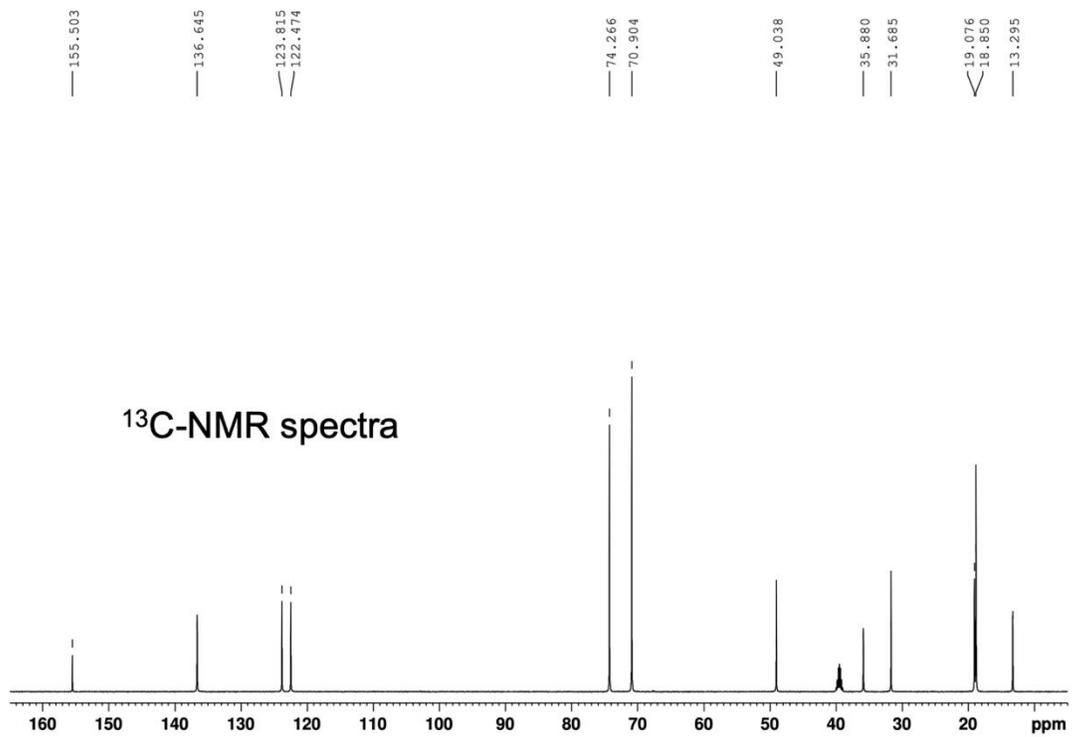
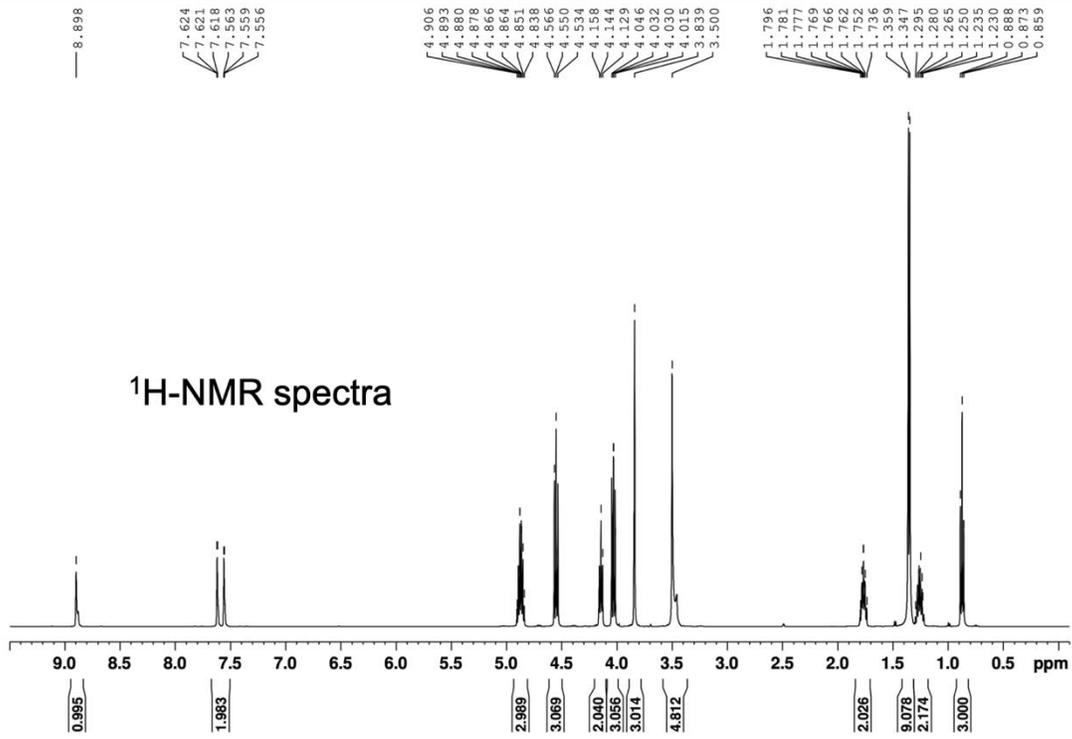


Figure S2 NMR spectra of catholyte results of 0.01Bi/Sn after CO₂RR at -1.1 V vs. Ag/AgCl for 70 min

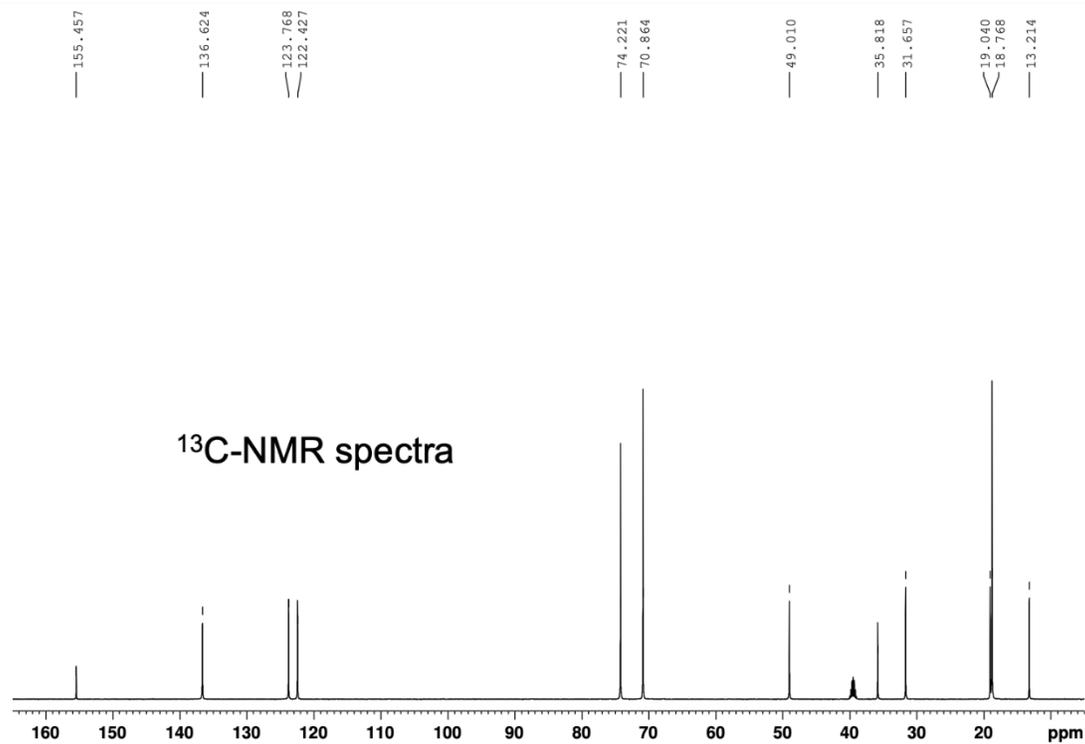
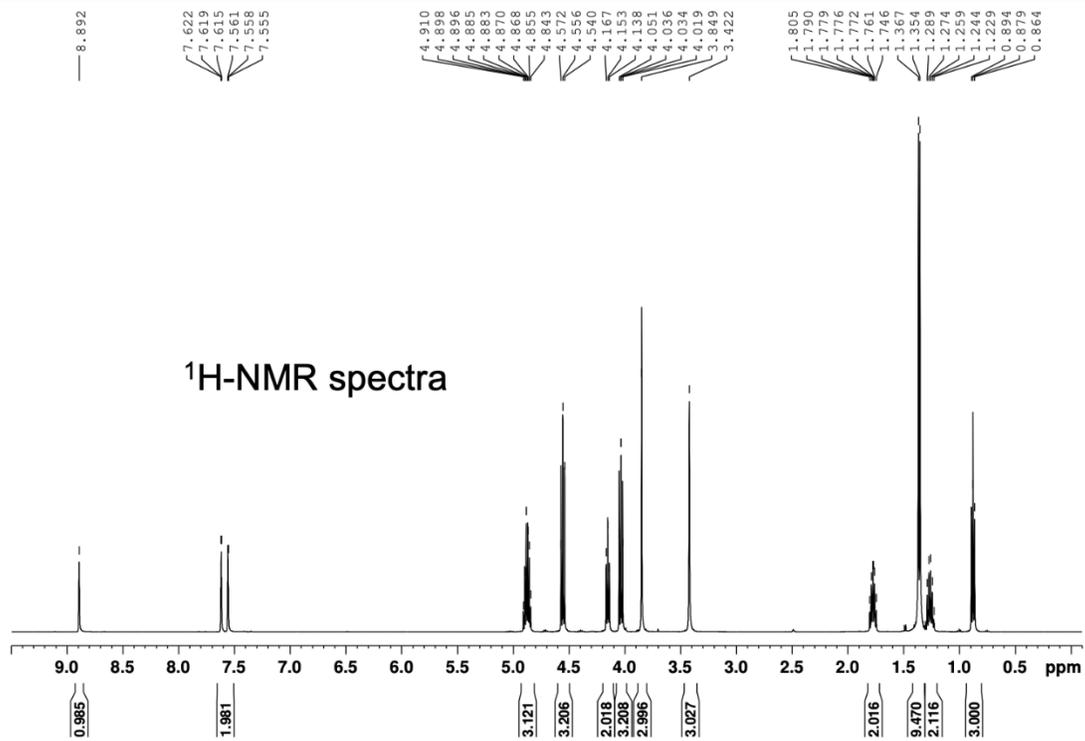


Figure S3 NMR spectra of catholyte results of 0.05Bi/Sn after CO₂RR at -1.1 V vs. Ag/AgCl for 70 min

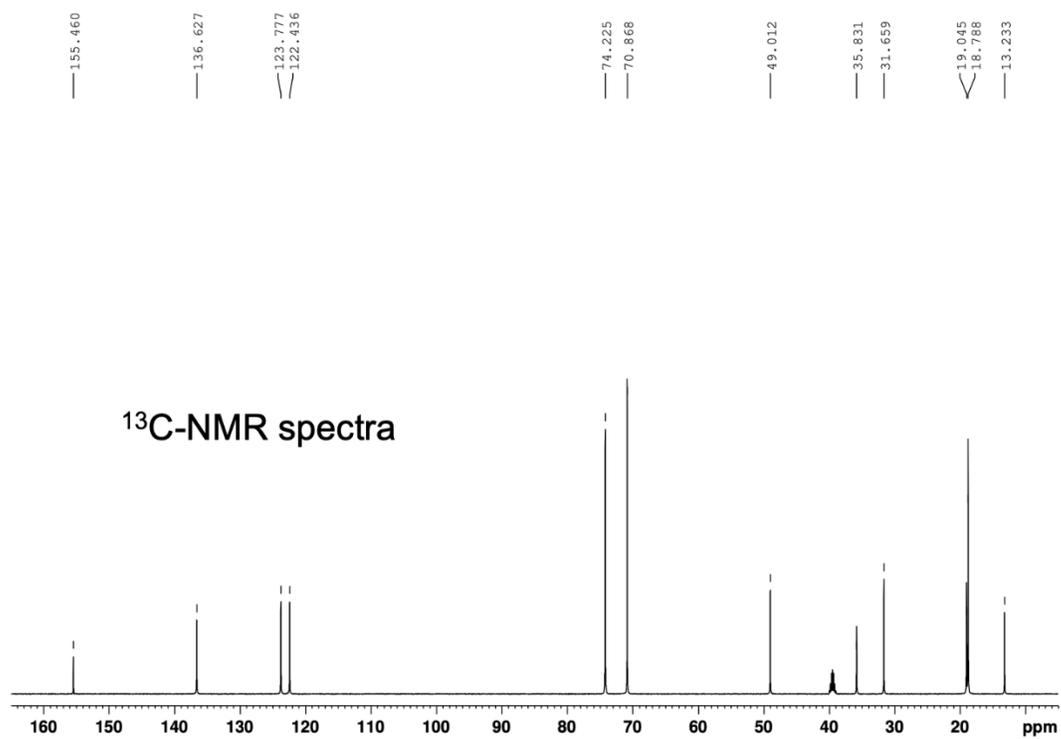
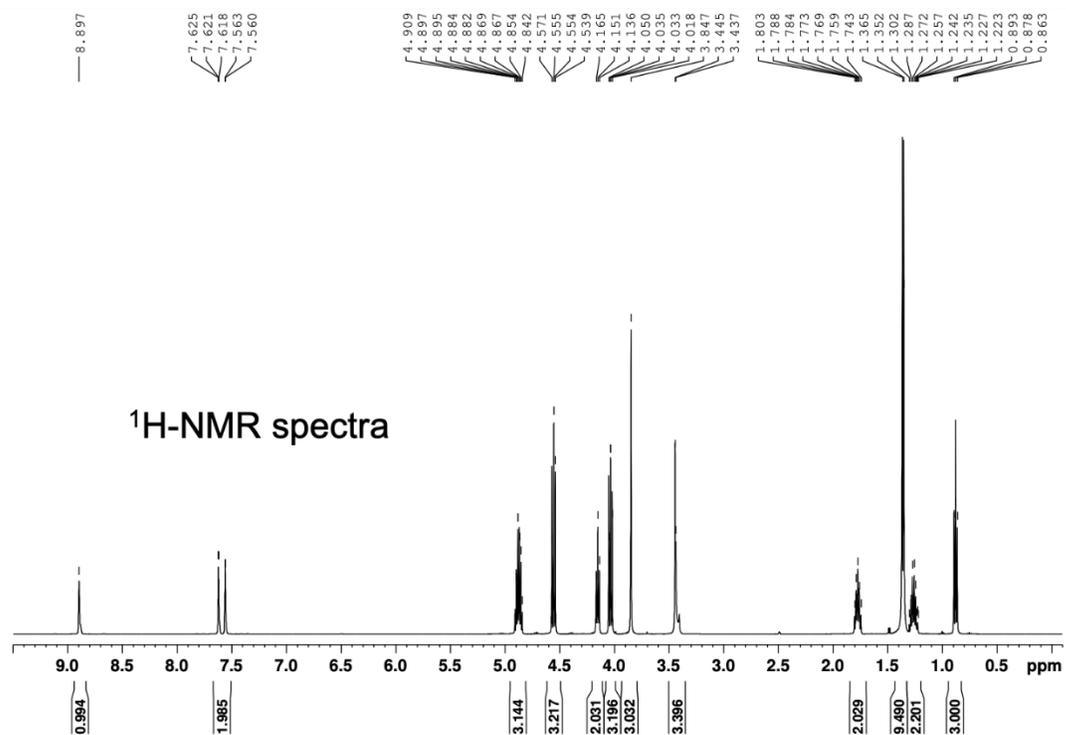


Figure S4 NMR spectra of catholyte results of 0.1Bi/Sn after CO₂RR at -1.1 V vs. Ag/AgCl for 70 min

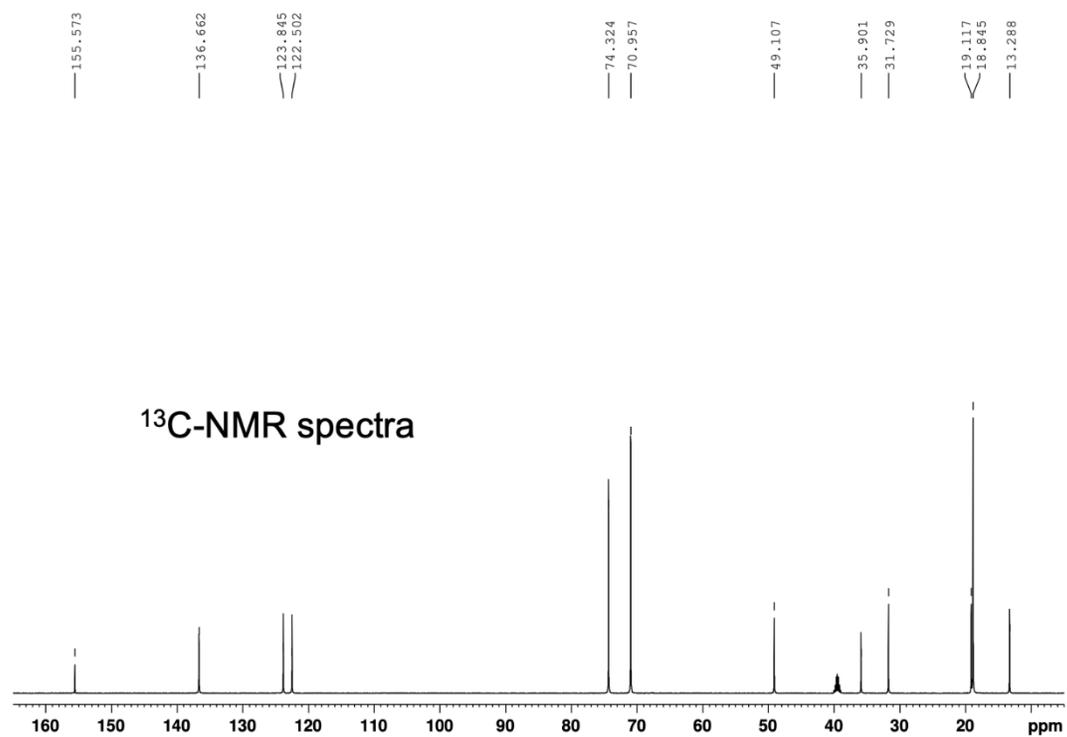
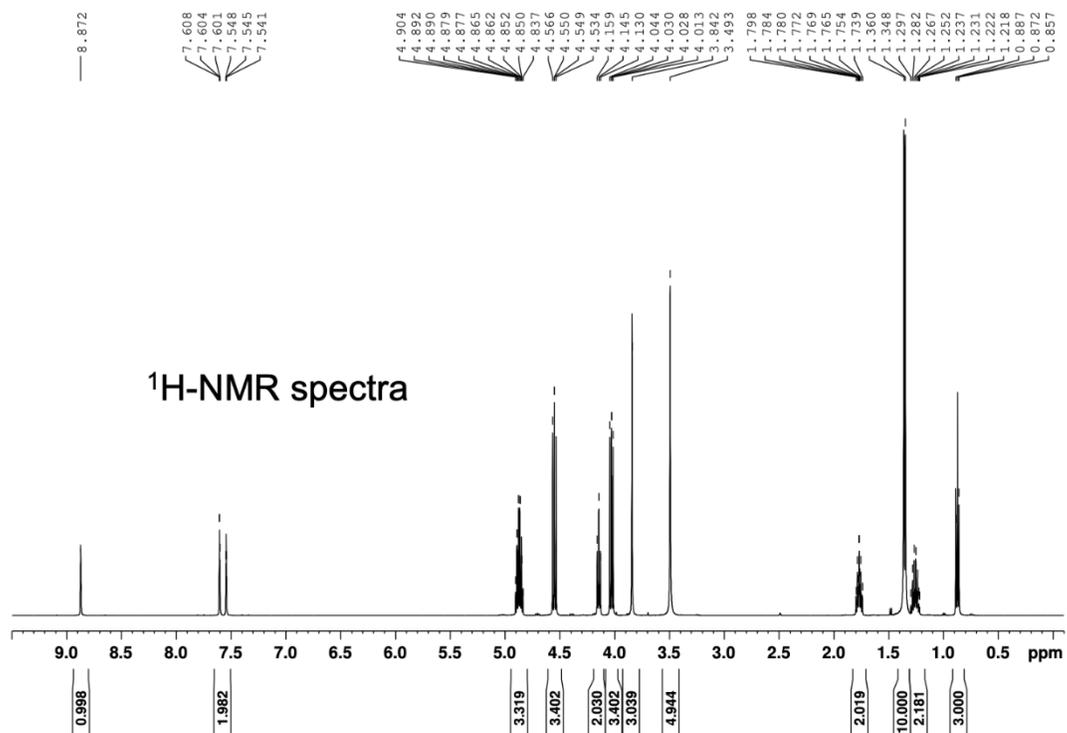


Figure S5 NMR spectra of catholyte results of 0.05Bi/Sn after CO₂RR at -1.3 V vs. Ag/AgCl for 70 min

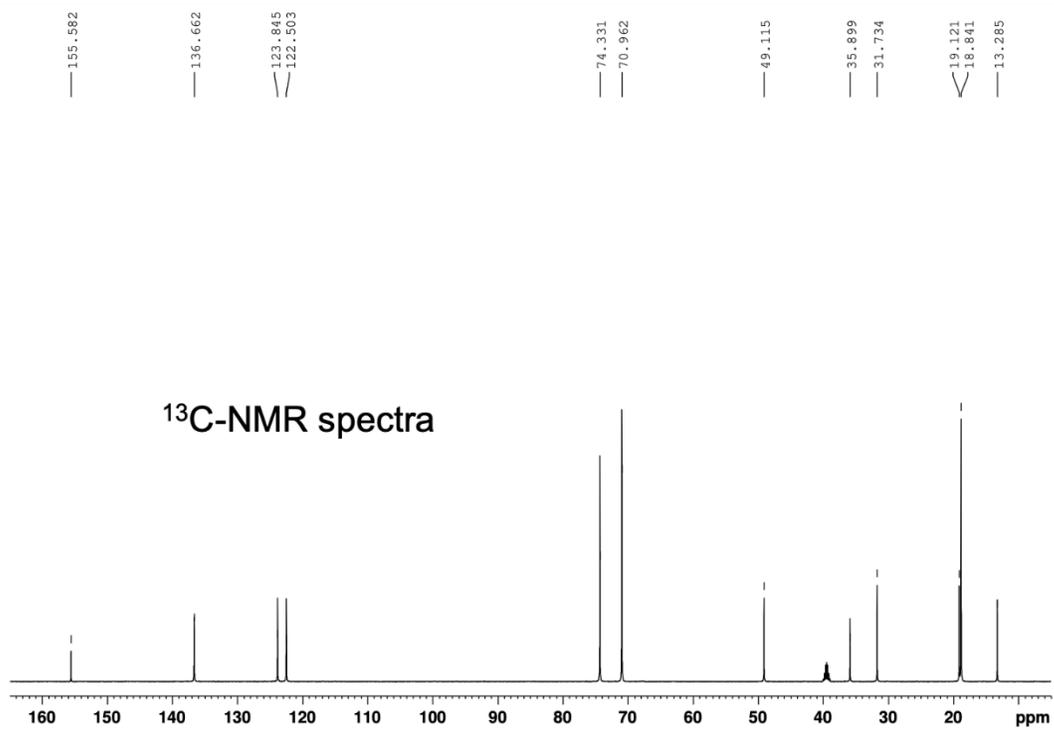
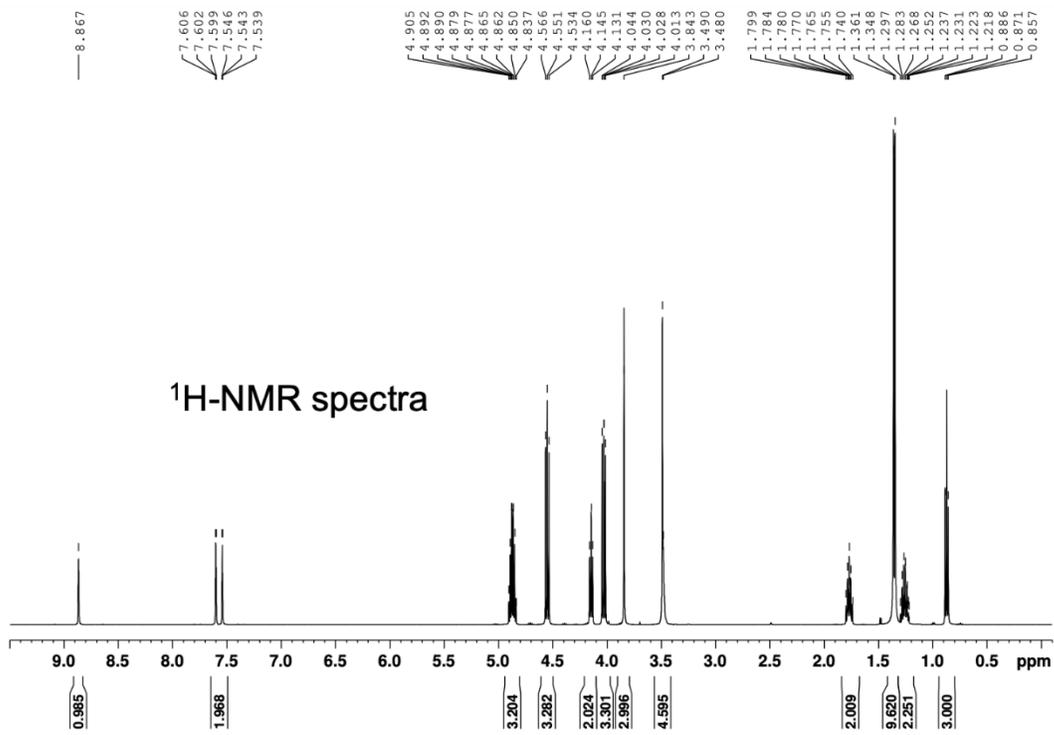


Figure S6 NMR spectra of catholyte results of 0.05Bi/Sn after CO₂RR at -1.5 V vs. Ag/AgCl for 70 min

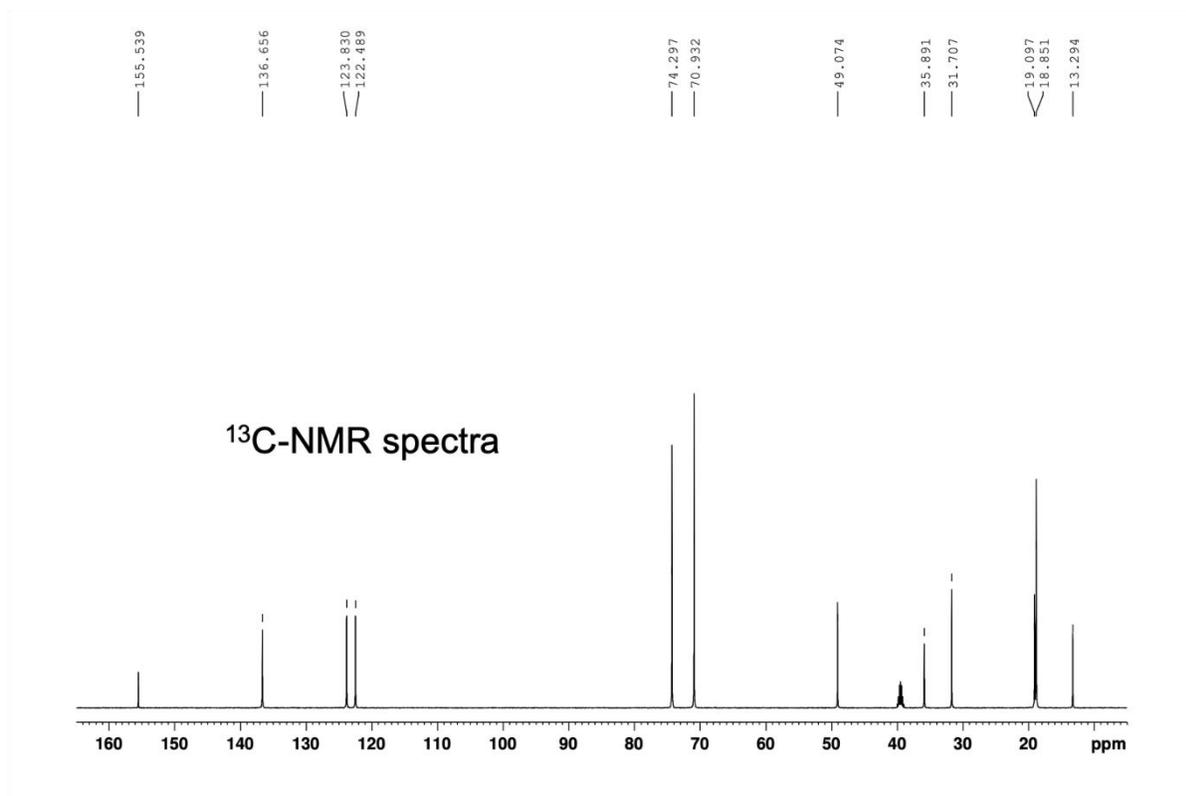
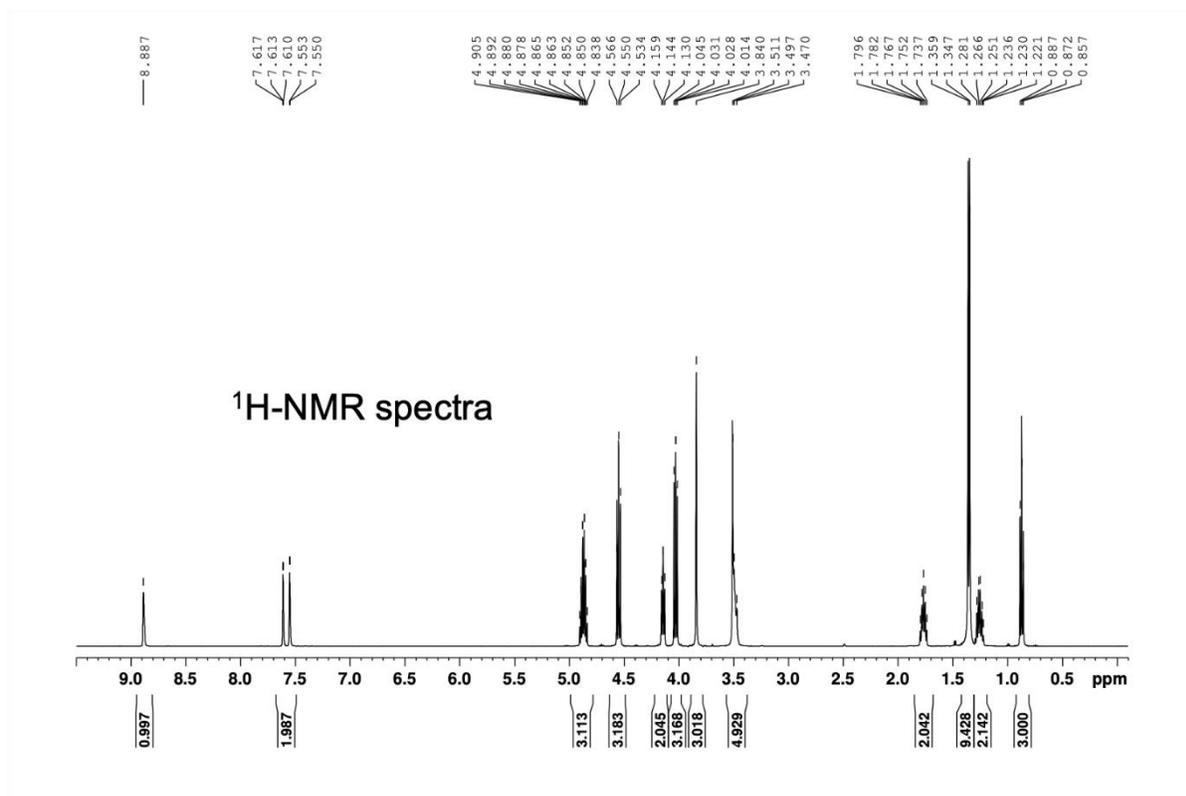
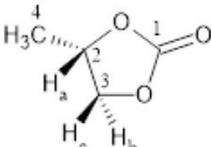
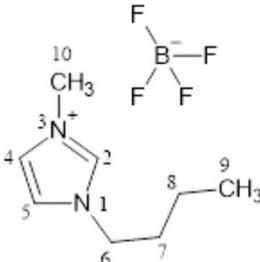
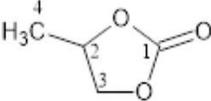
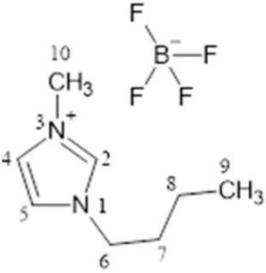


Figure S7 NMR spectra of catholyte results of 0.05Bi/Sn after CO₂RR at -1.7 V vs. Ag/AgCl for 70 min

(i) Analysis of ^1H -NMR spectra of cathodic electrolytes $[\text{BMIM}]^+[\text{BF}_4]^-$ and propylene carbonate before CO_2RR

Compounds	Molecular Structure	Chemical Shift (δ ppm)	
		Before Reaction (0 mins)	After Reaction (70 mins)
Propylene carbonate		(H2a, 1H, t) 4.88	(H2a, 1H, t) 4.84
		(H3b, 1H, dd) 4.54, $J=8$ Hz	(H3b, 1H, dd) 4.52, $J=8$ Hz
		(H3c, 1H, dd) 4.04, $J=8$ Hz	(H3c, 1H, dd) 4.01, $J=8$ Hz
		(H4, 3H, s) 1.38	(H4, 3H, s) 1.35
1-Butyl-3-methylimidazolium tetrafluoroborate		(H2, 1H, t) 8.96	(H2, 1H, t) 8.76
		(H5, 1H, t) 7.68	(H5, 1H, t) 7.53
		(H4, 1H, t) 7.61	(H4, 1H, t) 7.50
		(H6, 2H, t) 4.14	(H6, 2H, t) 4.09
		(H7, 2H, m) 1.72	(H7, 2H, m) 1.72
		(H8, 2H, m) 1.24	(H8, 2H, m) 1.29
		(H9, 3H, t) 0.87	(H9, 3H, t) 0.83
(H10, 3H, s) 3.84	(H10, 3H, s) 3.84		

(ii) Analysis of ^{13}C -NMR spectra of cathodic electrolytes $[\text{BMIM}]^+[\text{BF}_4]^-$ and propylene carbonate before CO_2RR

Compounds	Molecular Structure	Chemical Shift (ppm)	
		Before Reaction (0 mins)	After Reaction (70 mins)
Propylene carbonate		(C1) 155.37	(C1) 155.64
		(C2) 74.16	(C2) 74.33
		(C3) 70.88	(C3) 70.91
		(C4) 18.95	(C4) 18.80
1-Butyl-3-methylimidazolium tetrafluoroborate		(C2) 136.80	(C2) 136.60
		(C4) 122.52	(C4) 122.30
		(C5) 123.84	(C5) 123.66
		(C6) 48.96	(C6) 49.09
		(C7) 31.73	(C7) 31.61
		(C8) 19.28	(C8) 19.07
		(C9) 13.43	(C9) 13.24
(C10) 35.92	(C10) 35.70		

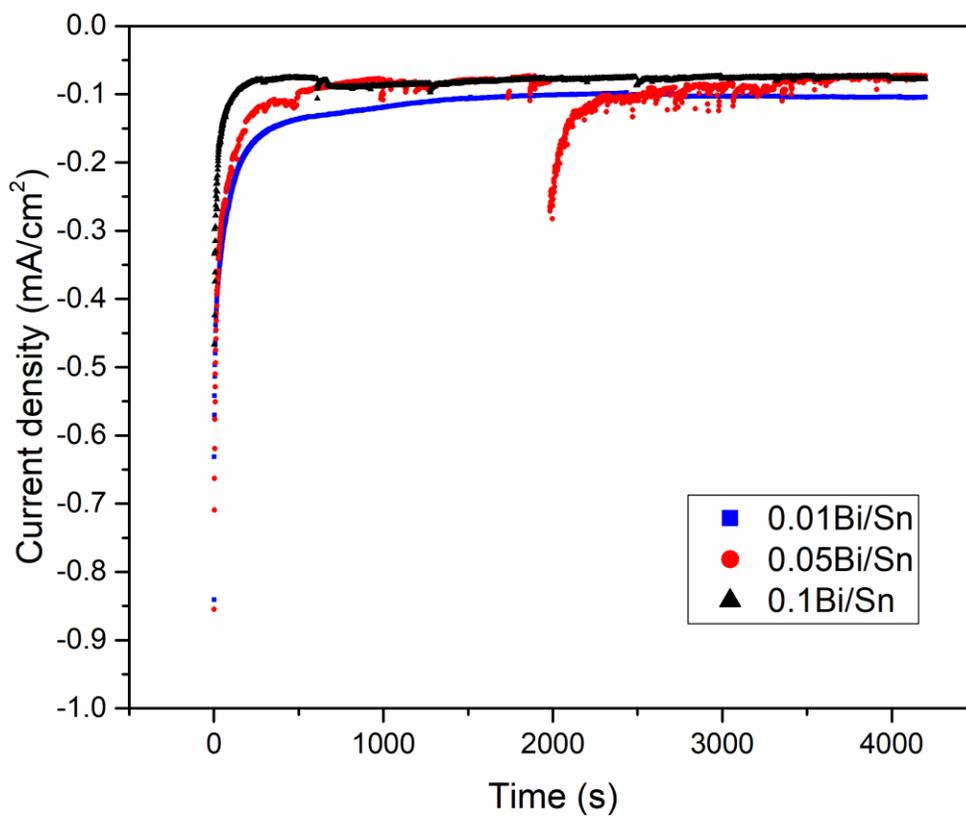


Figure S8 Current density of Bi/Sn during CO₂RR at -1.1 V vs. Ag/AgCl for 70 min

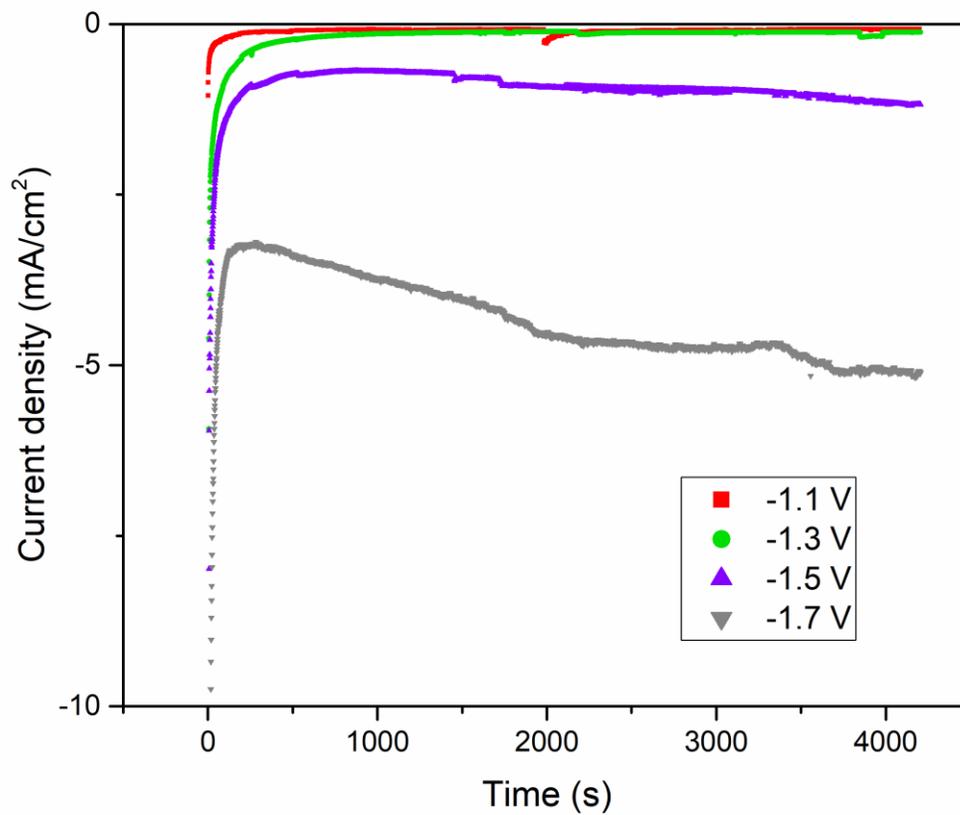


Figure S9 Current density of 0.05Bi/Sn during CO₂RR at various applied potentials vs. Ag/AgCl for 70 min