Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Supporting Information

CO_2 electroreduction on bimetallic Pd-In nanoparticles

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SUPPLEMENTARY FIGURES AND TABLES

Electrode	Composition (at%) from SEM-EDX		Metal loading on electrode (mg/cm^2)
	In	Pd	
In100	100	0	0.16
In95Pd5	96.7 ± 1.7	3.3 ± 1.7	0.19
In75Pd25	77.7 ± 3.1	22.3 ± 3.1	0.16
In50Pd50	53.1 ± 4.0	46.9 ± 4.0	0.11
Pd100	0	100	0.12

Table S.I. 1. Actual elemental composition of the catalysts and metal loadings on carbon cloth

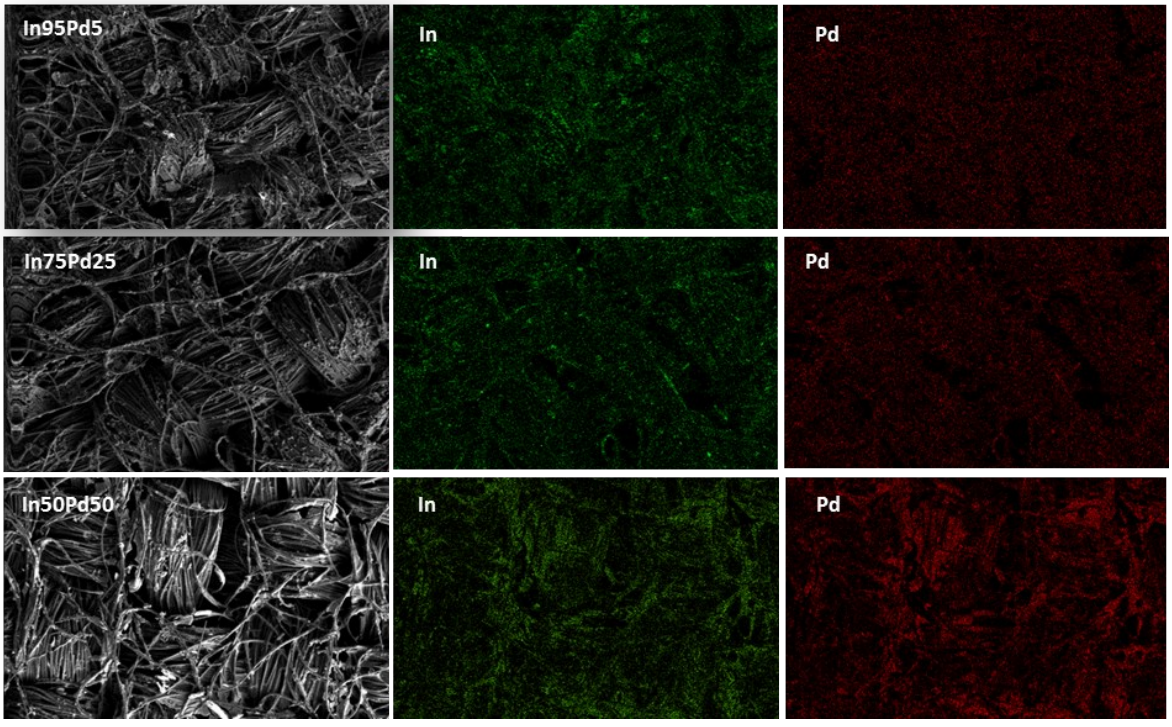


Figure S.I. 1 Elemental distribution in bimetallic catalysts. In and Pd are homogeneously dispersed on the carbon cloth.

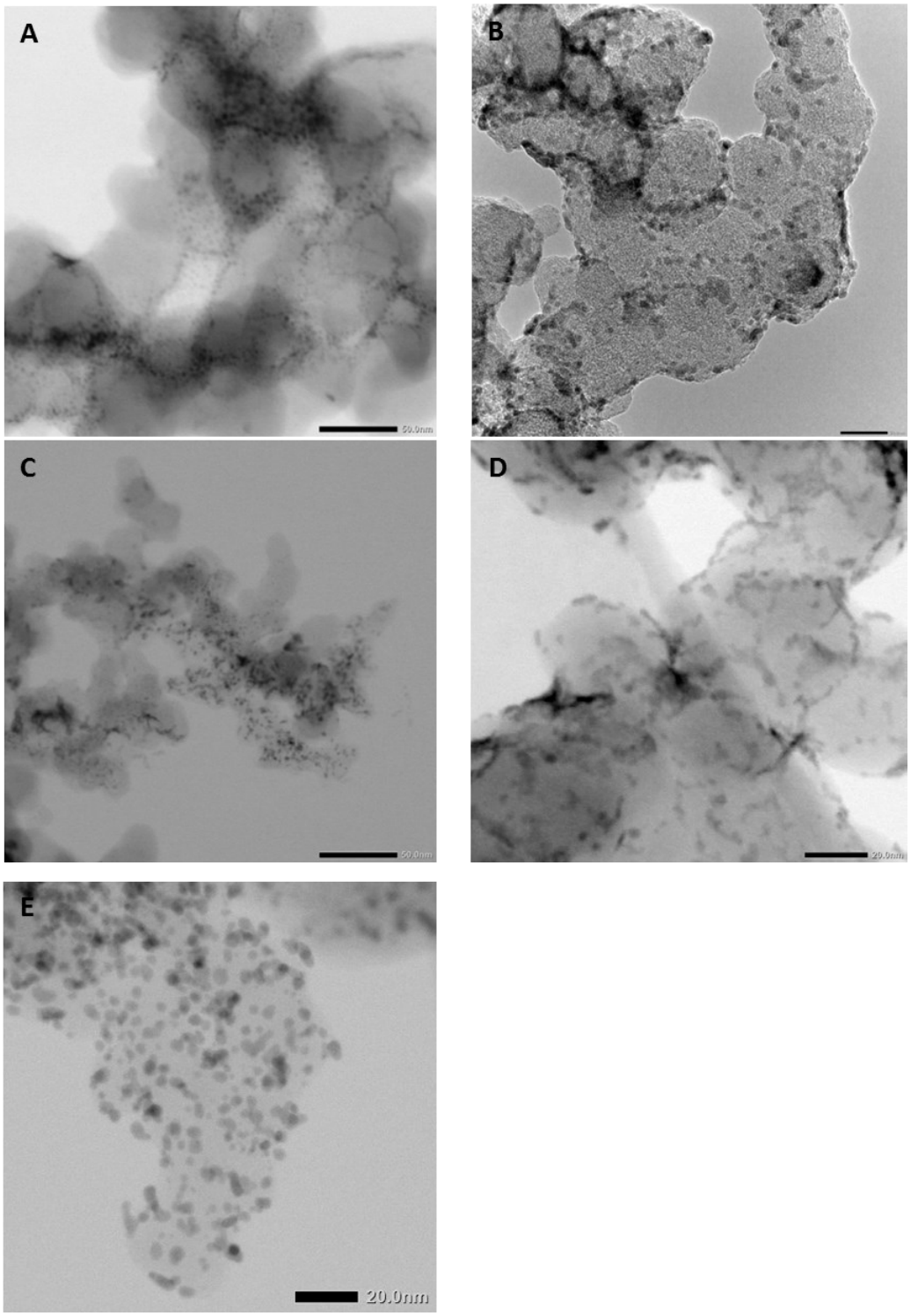
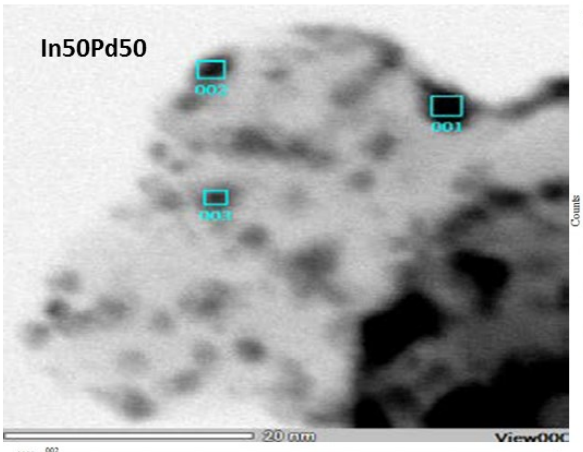
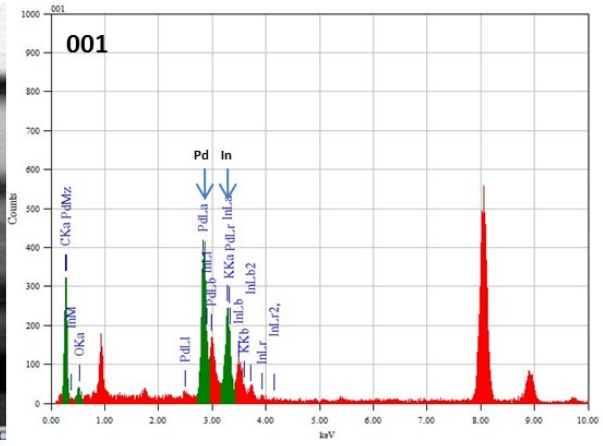
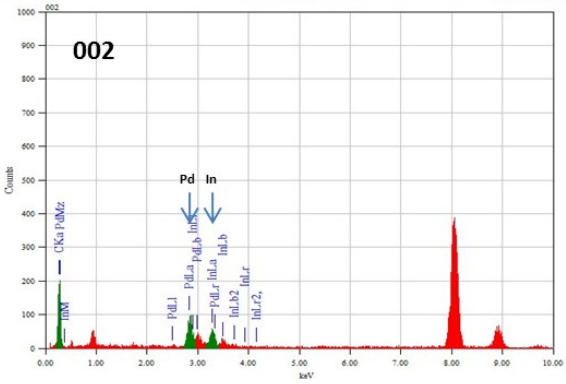
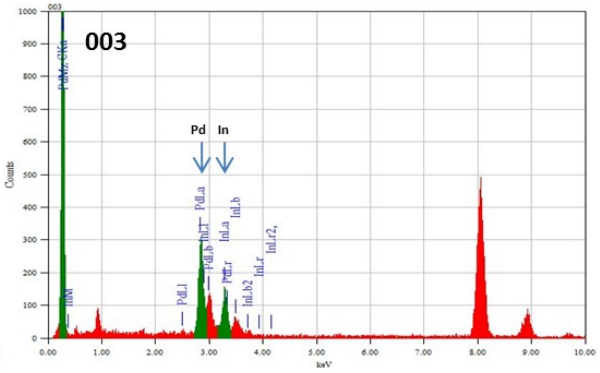


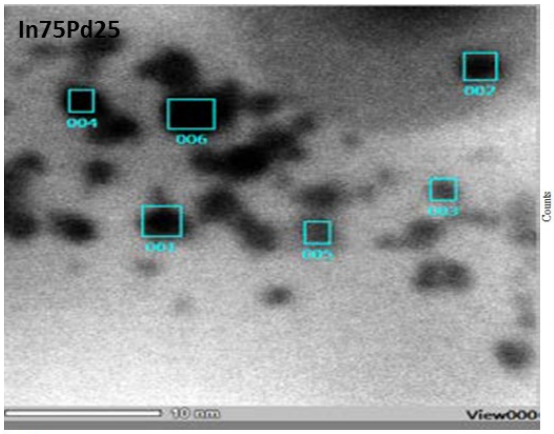
Figure S.I. 2 Some TEM pictures of (A) In/C, (B) In50Pd50/C, (C) In75Pd25/C, (D) In95Pd5/C and (E) Pd/C nanoparticles. (Scale bar A, C = 50 nm; scale bar B, D, E = 20 nm)

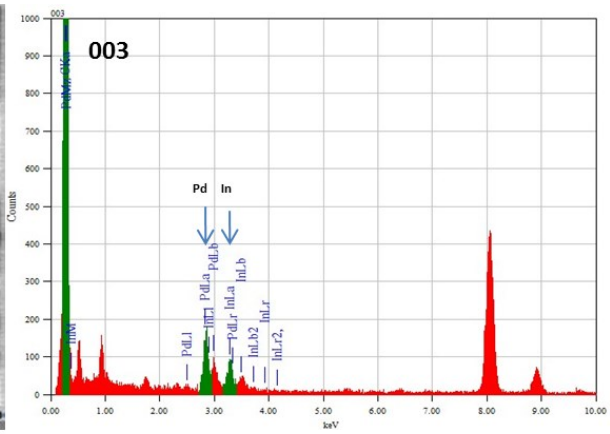

In50Pd50
002
001
003
20 nm

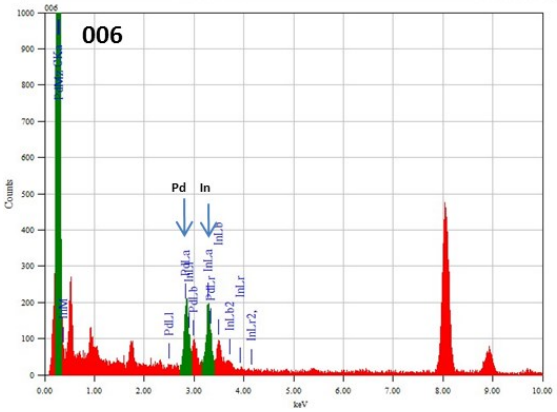

001
Pd
In
Counts
keV


002
Pd
In
Counts
keV


003
Pd
In
Counts
keV


In75Pd25
004
006
002
001
005
003
10 nm


003
Pd
In
Counts
keV


006
Pd
In
Counts
keV

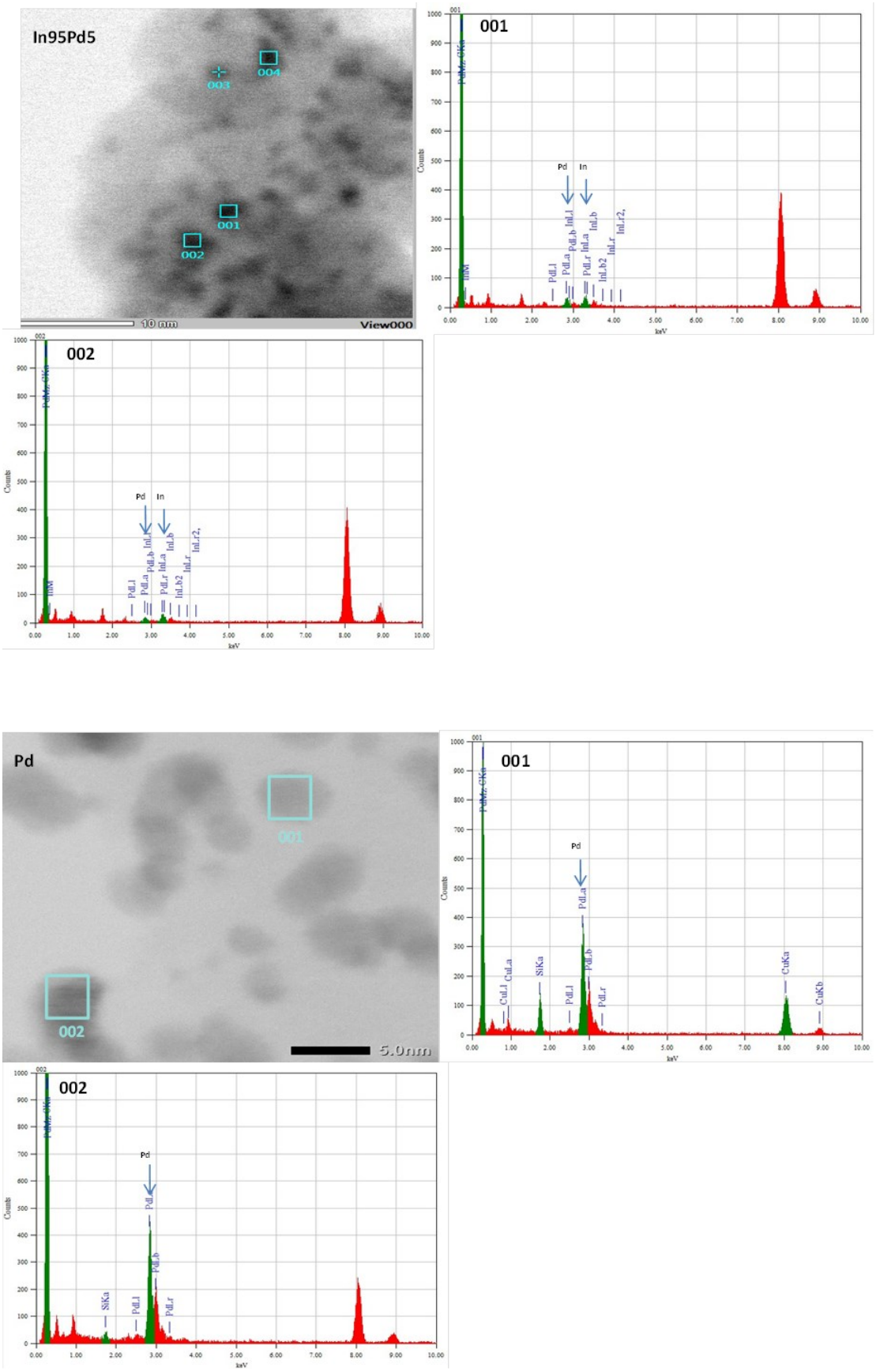


Figure S.I. 3 STEM-EDX spectra of some selected nanoparticles of different catalysts.

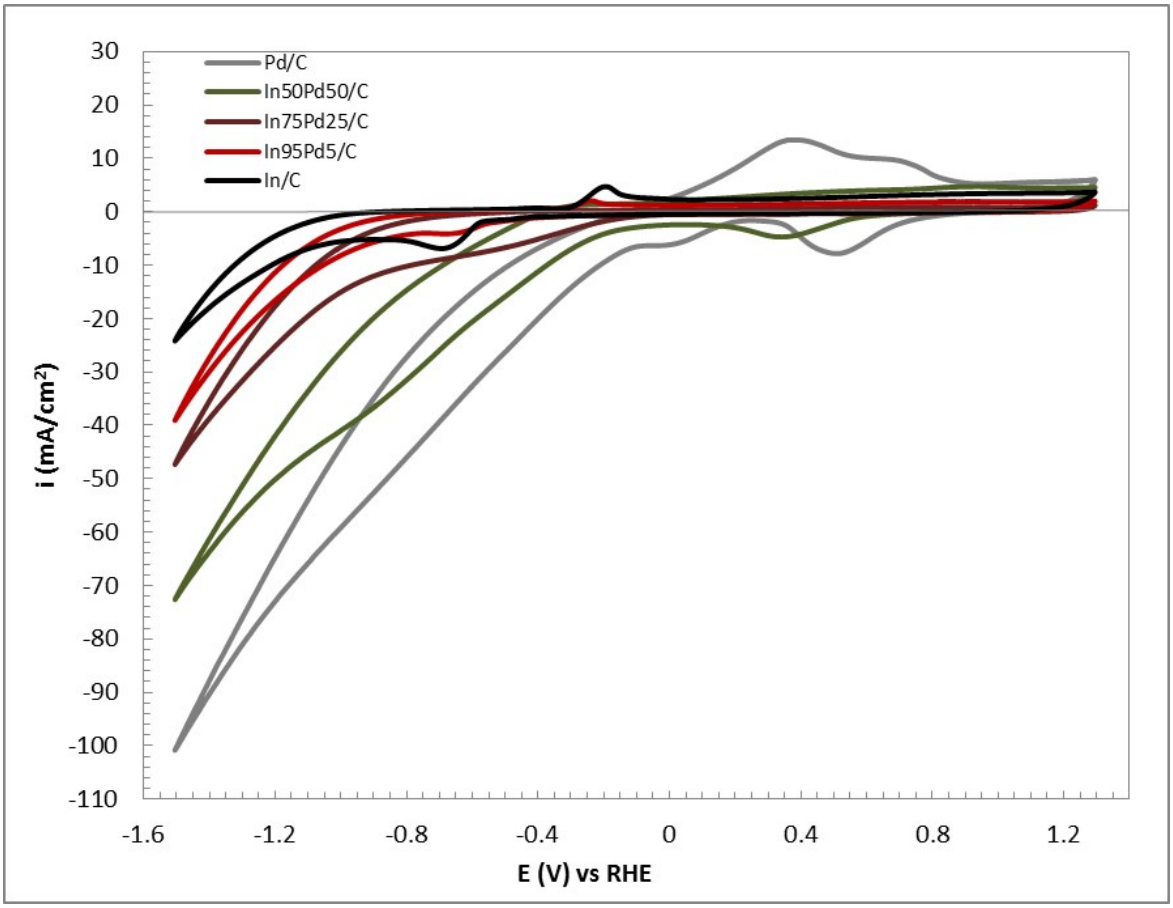


Figure S.I. 4 Cyclic voltammetries of the 5 catalysts in N_2 saturated 0.5M $KHCO_3$. Notice how the onset potential of HER shifts positively and results in higher currents. Also, the shape of the CVs, especially in In50Pd50/C and In75Pd25/C is dramatically changed and doesn't show characteristic peaks of either In or Pd.

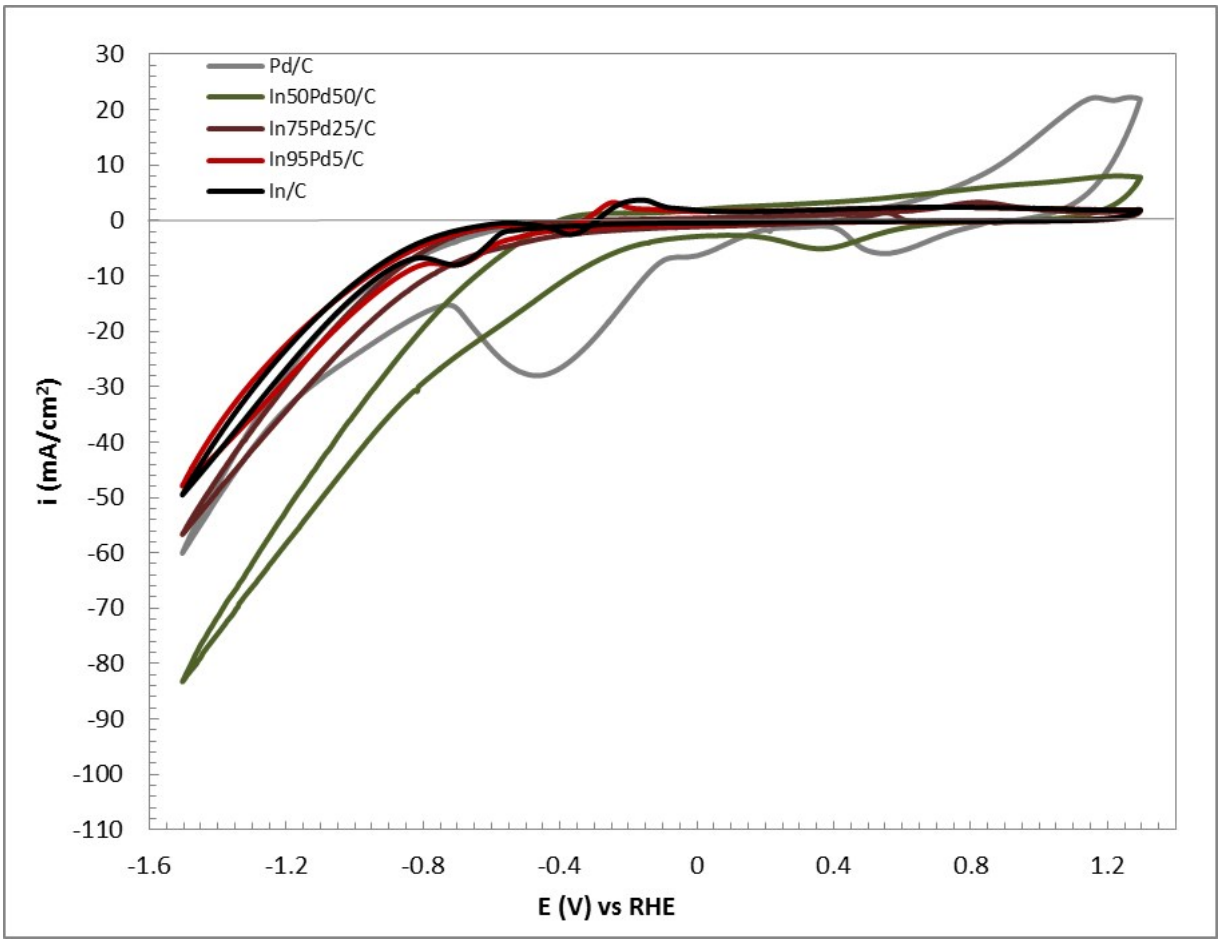


Figure S.I. 5 Cyclic voltammetries of the 5 catalysts in CO_2 saturated $KHCO_3$.

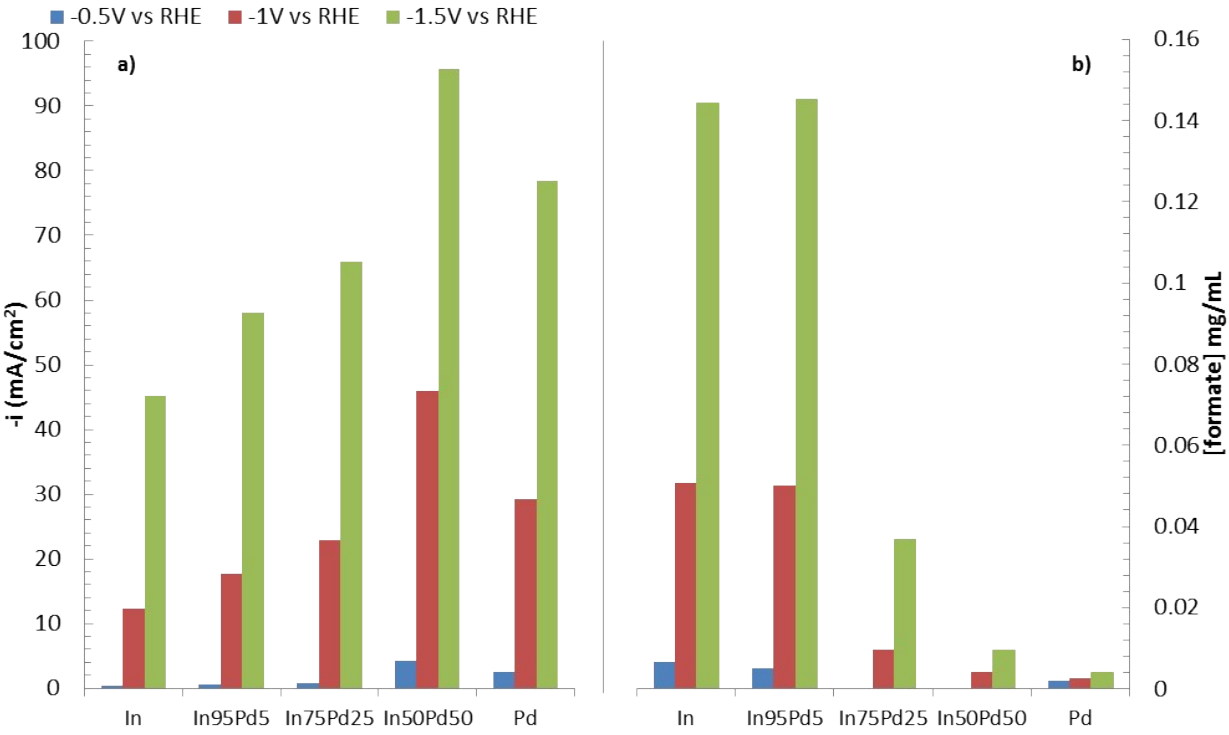


Figure S.I. 6 a) Current densities during the bulk electrolysis at the different potentials on all the catalysts. b) Concentrations of formate in mg/mL at the end of every 30 minute potential step for all the catalysts. In In95Pd5 the productivity of formate is the same as pure In, but the current is higher, resulting in a lower faradaic yield (see Figure 4 in the main manuscript).

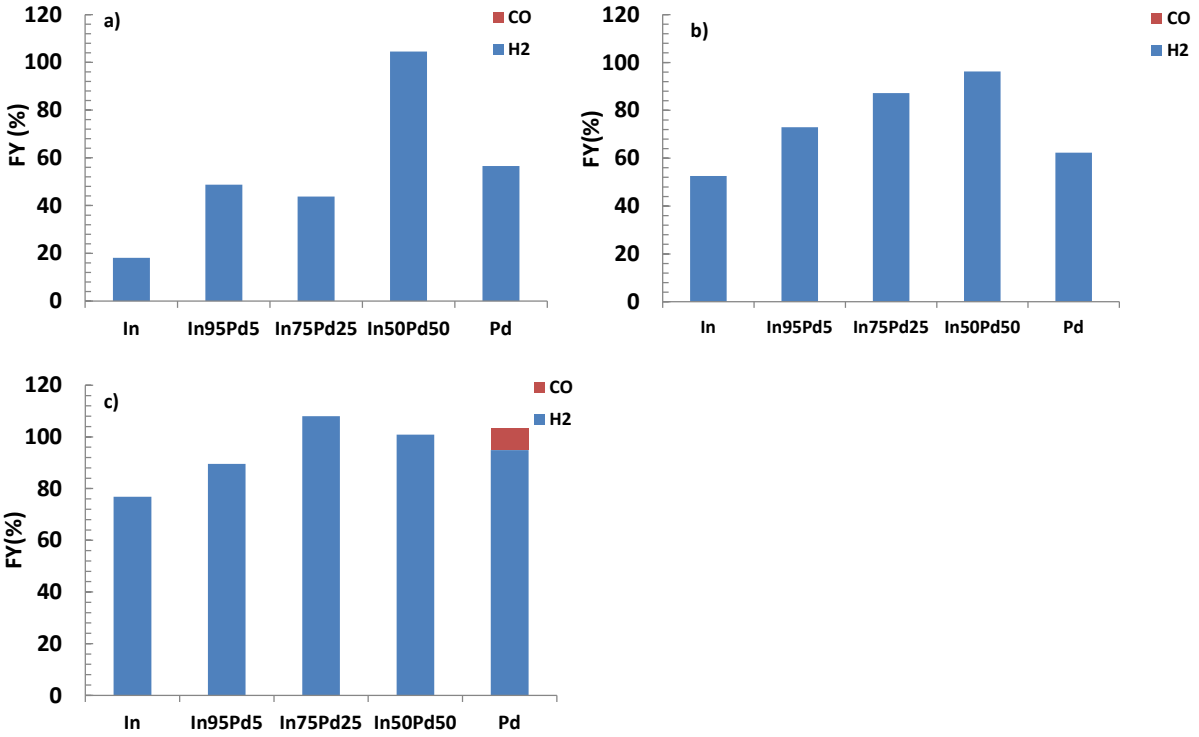


Figure S.I. 7 FY to gaseous products on the 5 catalysts at a) -0.5V vs RHE; b) -1V vs RHE and c) -1.5V vs RHE. Considering the contribution from formate to the FY (main manuscript) Pd at -0.5V and -1V gives FY lower

than 100%, this is likely due to the absorption of H in the Pd lattice as well as the formation of tightly bound CO which is not released. In, In95Pd5 and In75Pd25 at -0.5V also give FY significantly lower than 100%, this is probably due to part of the charge reducing oxides formed during air exposure. Always considering the formate contribution illustrated in the main manuscript: some runs give FY slightly above 100%. This is expected since different analytical methods are used for the detection of the products. Also, since during gas detection the system had to be sealed, the data for liquid-phase and gas-phase products come from different experiments.