

Supplementary material

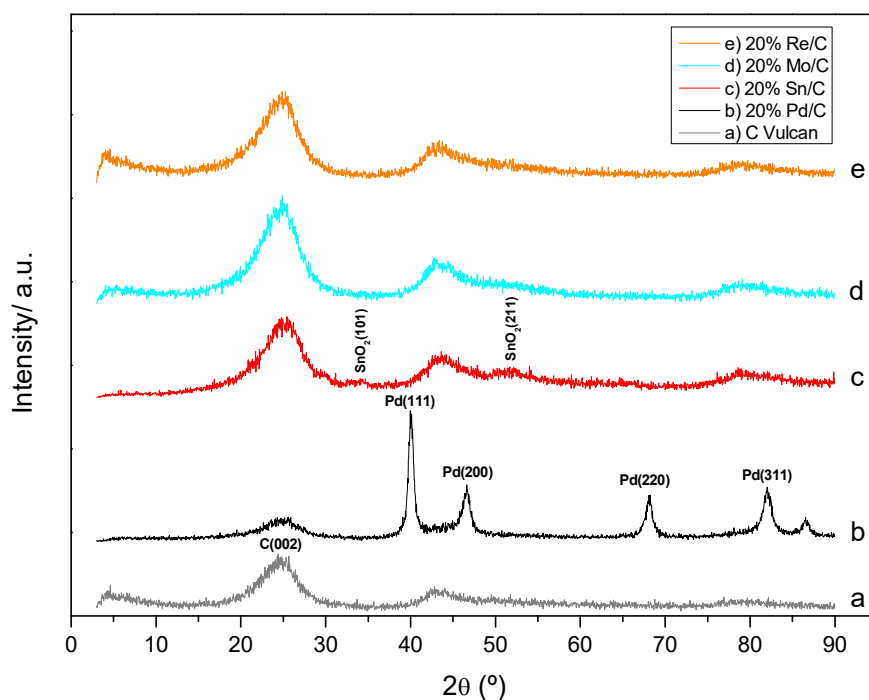


Figure S1. XRD pattern of carbon Vulcan and different metals studied over carbon: a) Carbon Vulcan; b) 20 % Pd/C; c) 20 % Sn/C; d) 20 % Mo/C; e) 20 % Re/C.

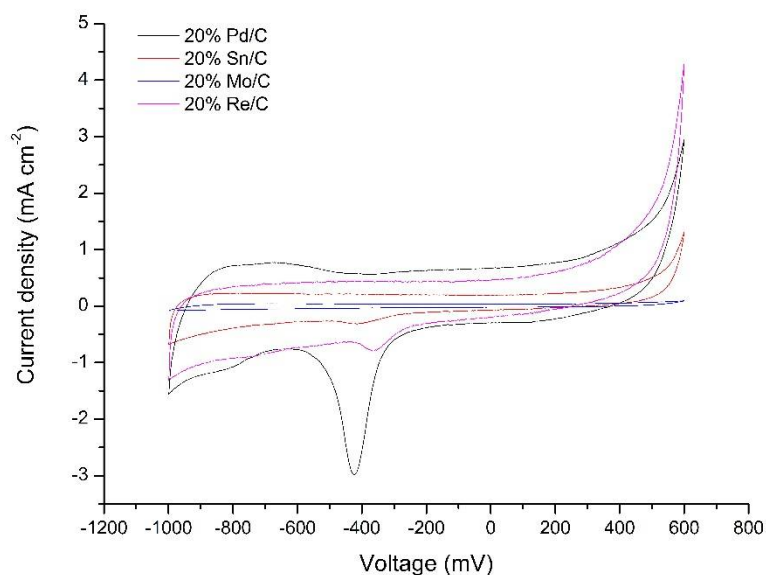


Figure S2. Comparison of cyclic voltammograms obtained for the different co-metals (20% Sn, Mo and Re over carbon) and 20% Pd/C catalyst in a solution of KOH 1.0 mol l^{-1} . E (mV) vs Ag/AgCl (3 M)). (Scan rate: 50 mV s^{-1} at room temperature)

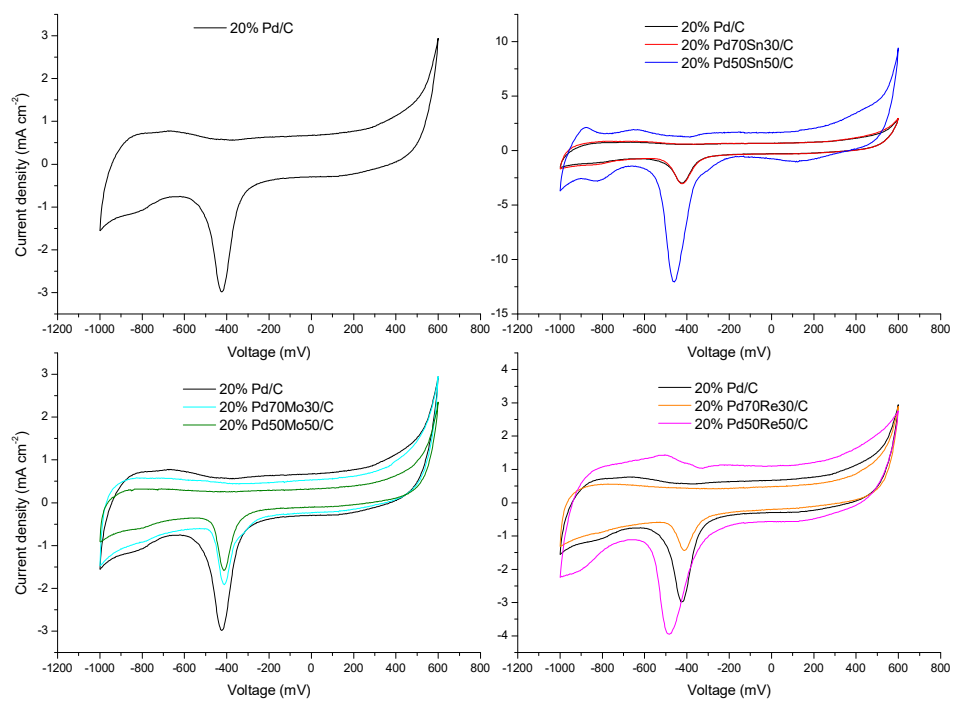


Figure S3. Comparison of cyclic voltammograms obtained for bimetallic catalysts with different co-metals (Sn, Mo and Re) and Pd/C catalyst in a solution of KOH 1.0 mol l⁻¹. E (mV) vs Ag/AgCl (3 M)). (Scan rate: 50 mV s⁻¹ at room temperature)

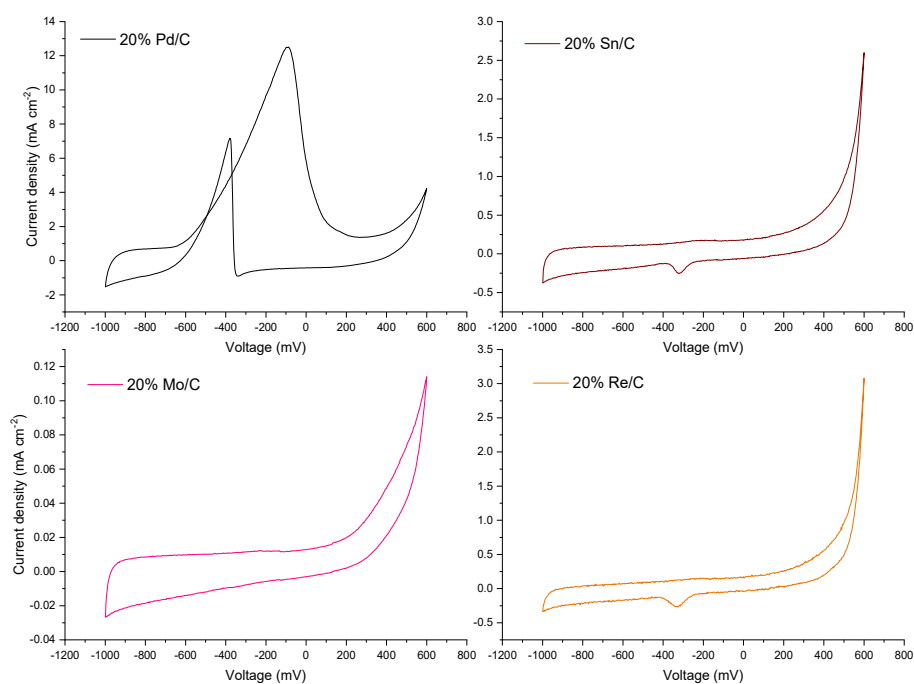


Figure S4. Performance of the different cometal over carbon in a solution of KOH 1.0 mol l⁻¹ + EtOH 1.0 mol l⁻¹. E (mV) vs Ag/AgCl (3 M)). (Scan rate: 50 mV s⁻¹ at room temperature)

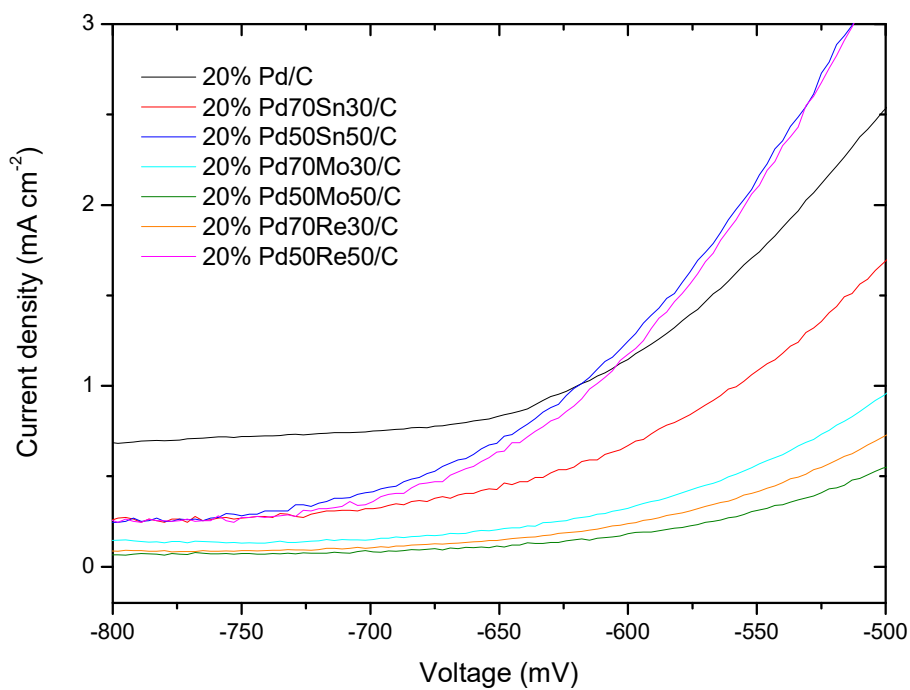


Figure S5. Onset potential for the different catalysts studied: 20 % Pd/C (—), 20 % Pd₇₀Sn₃₀/C (—), 20 % Pd₅₀Sn₅₀/C (—), 20 % Pd₇₀Mo₃₀/C (—), 20 % Pd₅₀Mo₅₀/C (—), 20 % Pd₇₀Re₃₀/C (—) and 20 %

Pd₅₀Re₅₀/C (—). Solution of KOH 1.0 mol l⁻¹ + EtOH 1.0 mol l⁻¹. (Scan rate: 50 mV s⁻¹ at room temperature)

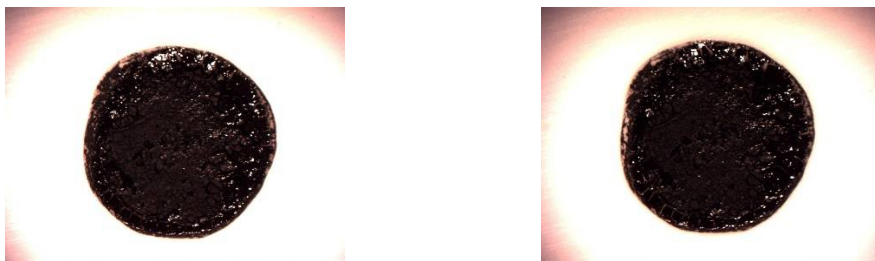
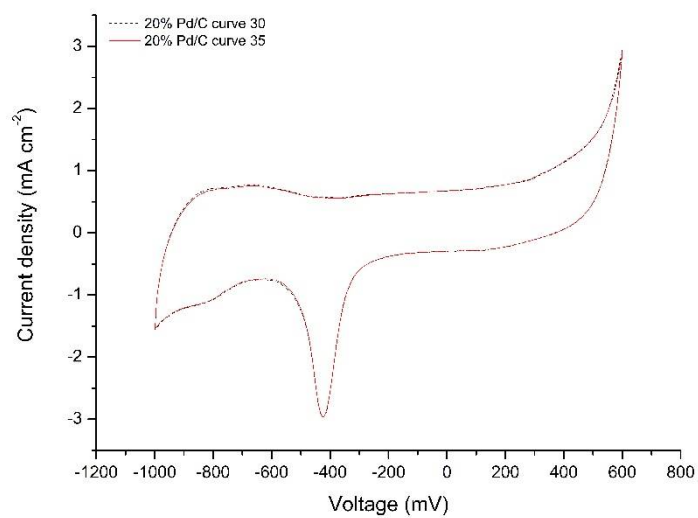
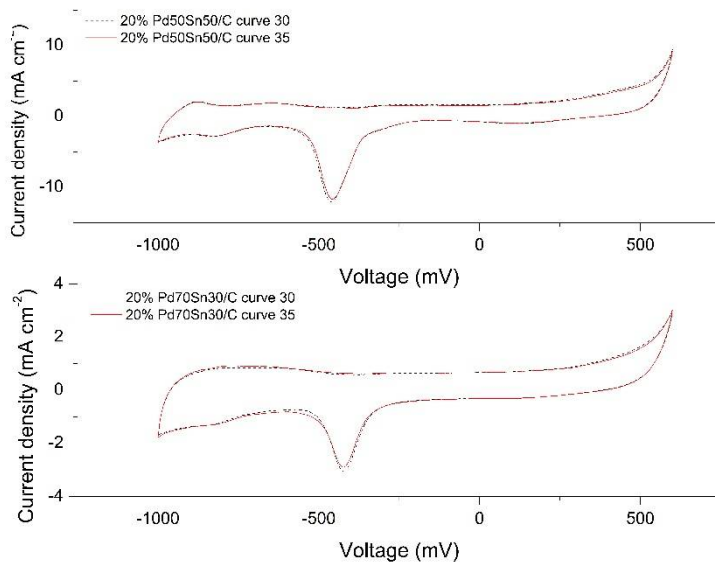


Figure S6. Microscopy images of the sample over the glassy carbon electrode before (left) and after (right) the electrochemical reaction in a solution of KOH 1 mol l⁻¹ containing EtOH 1 mol l⁻¹.

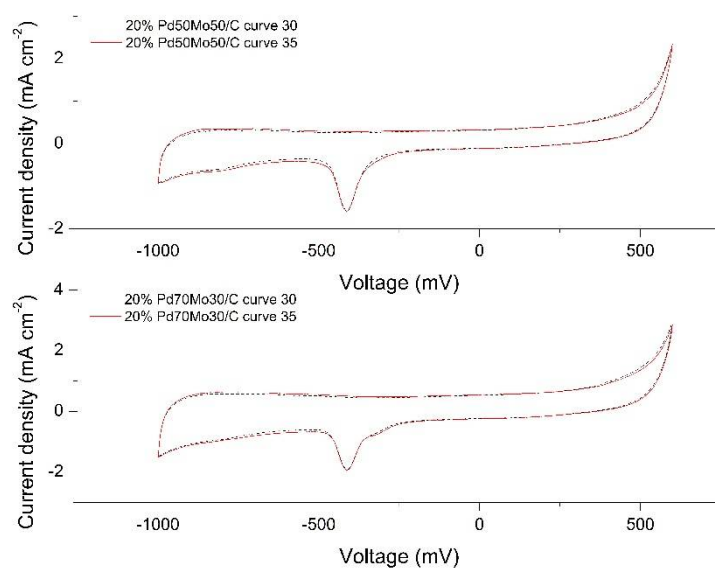
a)



b)



c)



d)

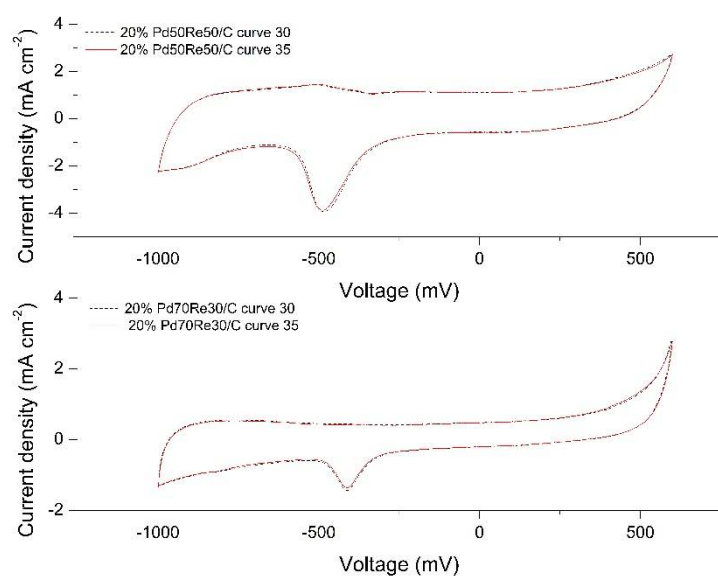


Figure S7. Consecutive CVs cycles in a solution of KOH 1 mol l⁻¹ for: a) Pd/C catalysts; b) Pd-Sn/C catalysts; c) Pd-Mo/C catalysts; d) Pd-Re/C catalysts. E (mV) vs Ag/AgCl (3 M)). (Scan rate: 50 mV s⁻¹ at room temperature)