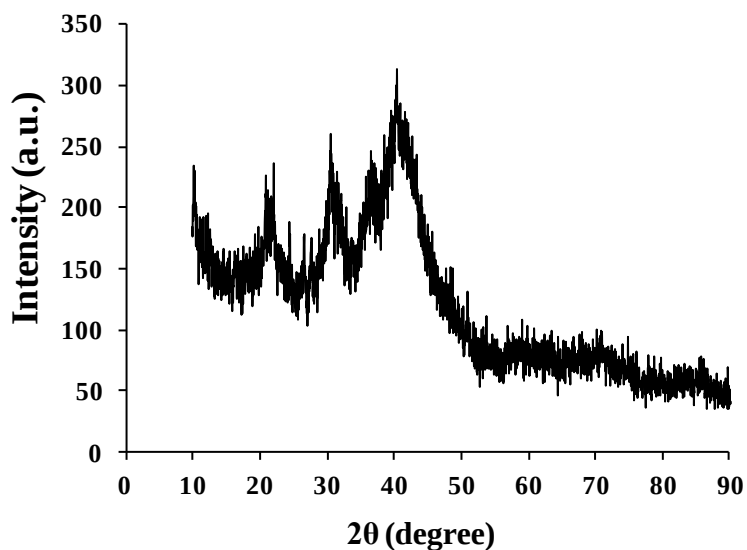


Synthesis of PtCu₃ bimetallic nanoparticles as oxygen reduction catalysts via a sonochemical method

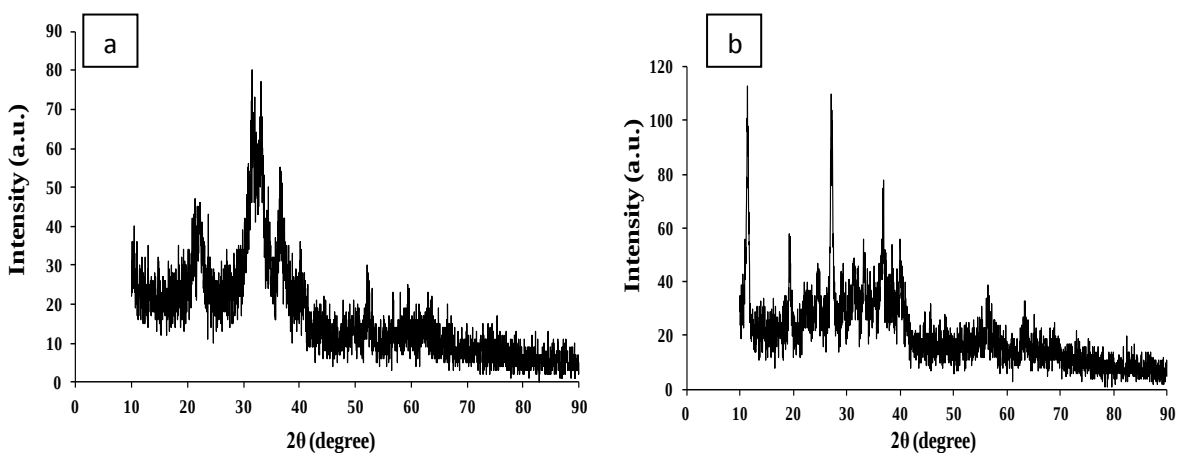
Cenk Gümeçi,^a D. Ua Cearnaigh,^a Dominick J. Casadonte Jr.^a and Carol Korzeniewski*^a

^a Department of Chemistry and Biochemistry, Texas Tech University, Lubbock, Texas 79409-1061, USA.

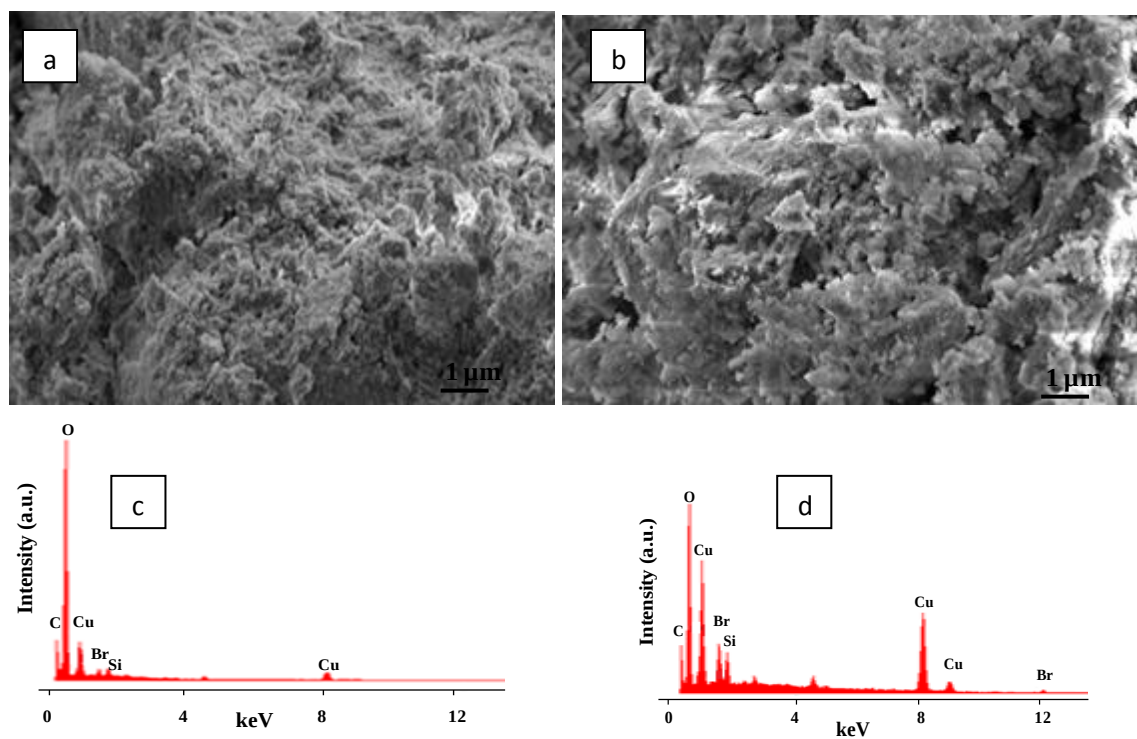
E-mail: carol.korzeniewski@ttu.edu



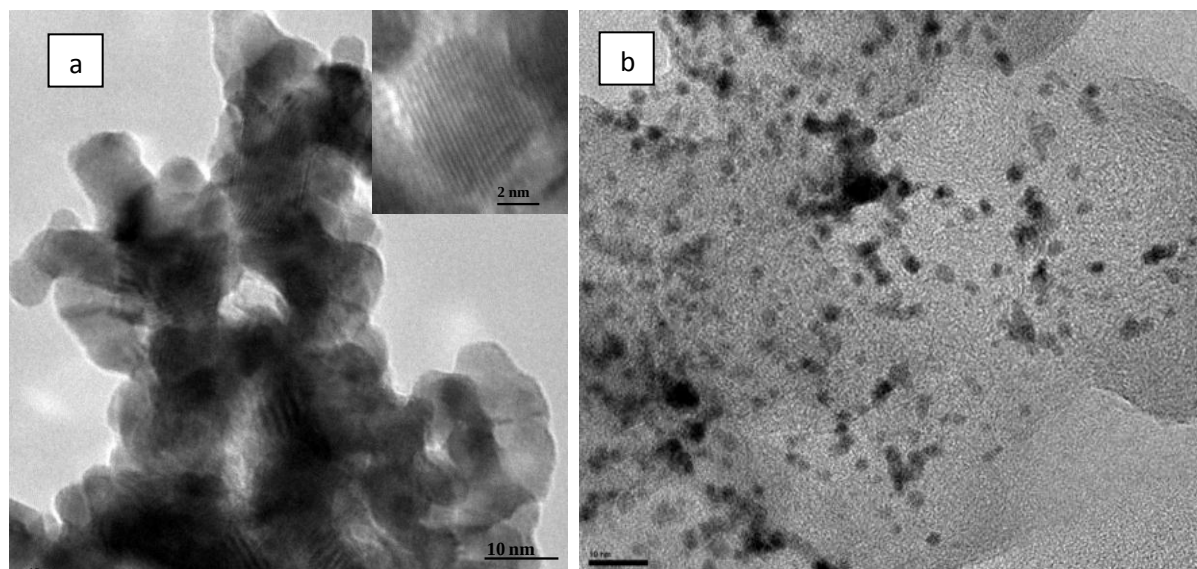
S.1 X-ray diffraction patterns for PtCu-control sample.



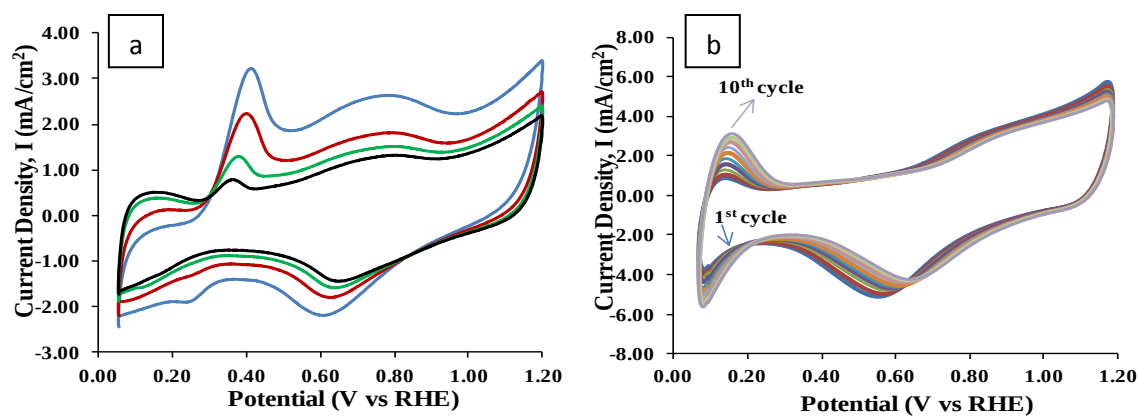
S.2 X-ray diffraction patterns for **a)** Cu-sono and **b)** Cu-control samples.



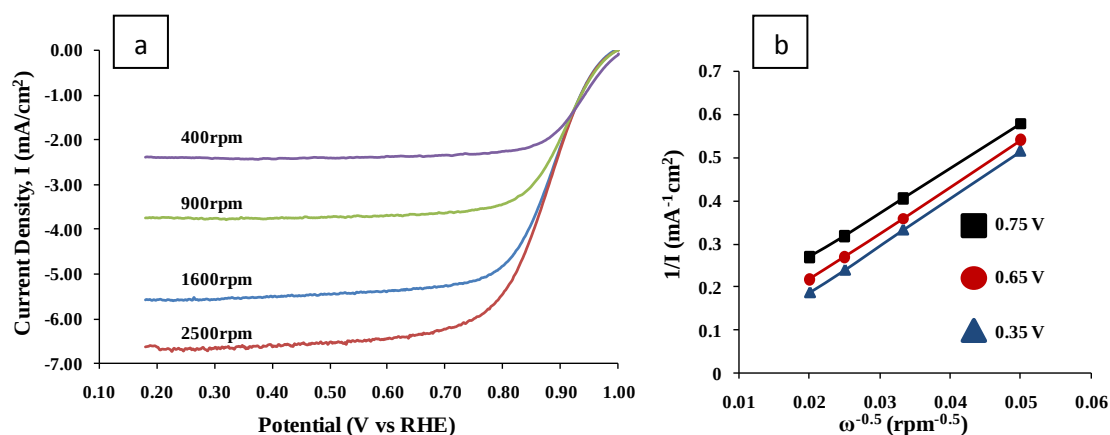
S.3 SEM images of **a)** Cu-sono and **b)** Cu-control. EDX spectra of **c)** Cu-sono and **d)** Cu-control.



S.4 a) TEM image of Pt-black. The inset shows a HR-TEM image of the sample. **b)** TEM image of Pt-C.

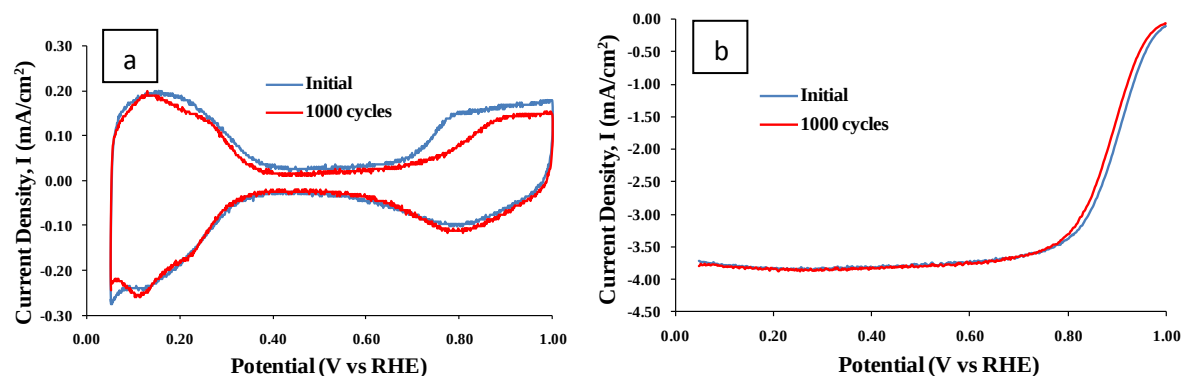


S.5 a) First four cycles of the PtCu₃-sono-C particles in de-aerated 0.1 M HClO₄ solution at a 100 mV s⁻¹ scan rate. **b)** First ten fast cycles (500 mV s⁻¹) during electrochemical de-alloying.



S.6 a) LSVs recorded as a function of rotation rate for de-alloyed PtCu₃-sono-C in O₂ saturated 0.1 M HClO₄ at 20 mV/s scan rate. **b)** Levich-Koutecky plots obtained from the data in at 0.35, 0.65 and 0.75 V. Current densities are normalized to the geometric surface area of the glassy carbon electrode. The Pt loading amount is $\sim 39 \mu\text{g}/\text{cm}^2_{(\text{geo})}$.

From S5 b, the average diffusion limited current (i_d) determined¹ from the data set at $\omega = 1600$ rpm was $5.48 \pm 0.20 \text{ mA}/\text{cm}^2$.



S.7 a) CVs recorded before and after durability cycling for de-alloyed PtCu₃-sono in 0.1 M HClO₄ at 50mV/s **b)** LSVs of de-alloyed PtCu₃-sono particles in O₂ saturated 0.1 M HClO₄ at 20 mV/s scan rate with a 1600 rpm rotation rate. Pt loading amount is $\sim 52 \mu\text{g}/\text{cm}^2_{(\text{geo})}$

Table S.1 O₂ reduction activities before and after durability cycling for Pt and de-alloyed PtCu₃-sono samples.

Sample	Specific Activity ^a [mA/cm ² _{Pt}] Before Durability	Mass Activity ^a [A/mg _{Pt}] Before Durability	Specific Activity ^a [mA/cm ² _{Pt}] After Durability	Mass Activity ^a [A/mg _{Pt}] After Durability
PtCu₃-sono	0.71	0.118	0.63	0.106
Pt-C	0.24	0.122	0.21	0.101
Pt-black	0.39	0.029	0.31	0.023

^a Specific and mass activity values are measured at 0.9 V.

1. U. A. Paulus, A. Wokaun, G. G. Scherer, T. J. Schmidt, V. Stamenkovic, V. Radmilovic, N. M. Markovic and P. N. Ross, *J. Phys. Chem. B*, 2002, **106**, 4181-4191.