



Investigation of Pt ternary alloy catalysts as PEMFC ORR catalysts

Z. Mseleku, T. Ngwenya, K. Tshehla,
C. Gray

2nd Southern African
Hydrogen and Fuel Cell

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Background and Introduction

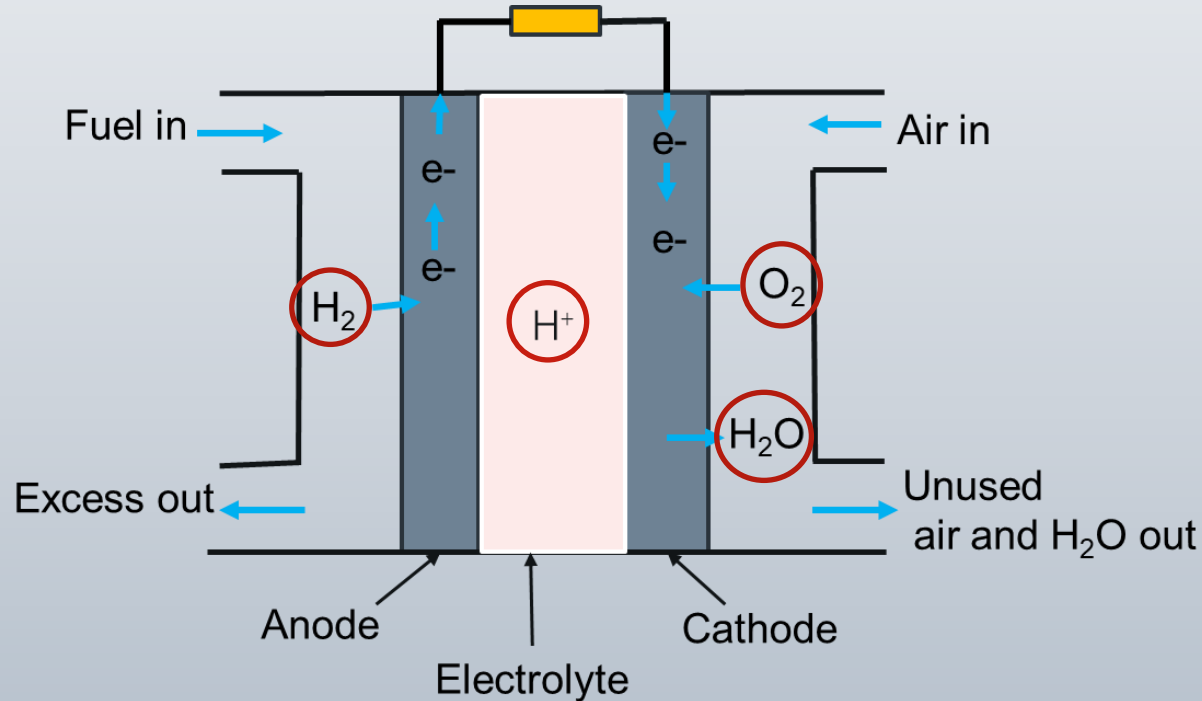
❖ Proton Exchange Membrane

Fuel Cells (PEMFC's) are a viable technology for clean energy production due to:

- low operating temperature
- zero carbonaceous emissions
- high energy density and efficiency

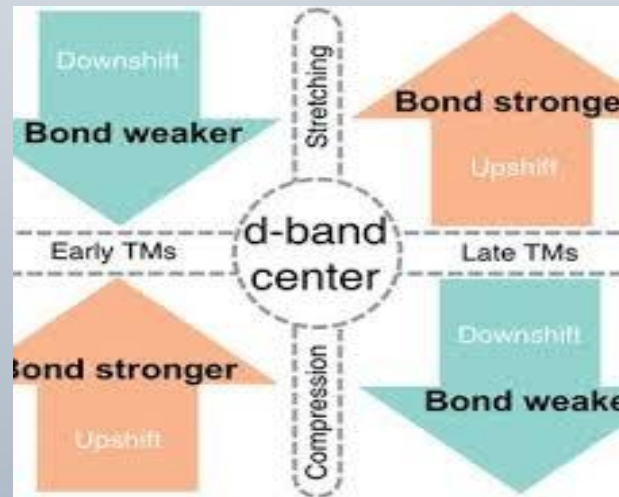
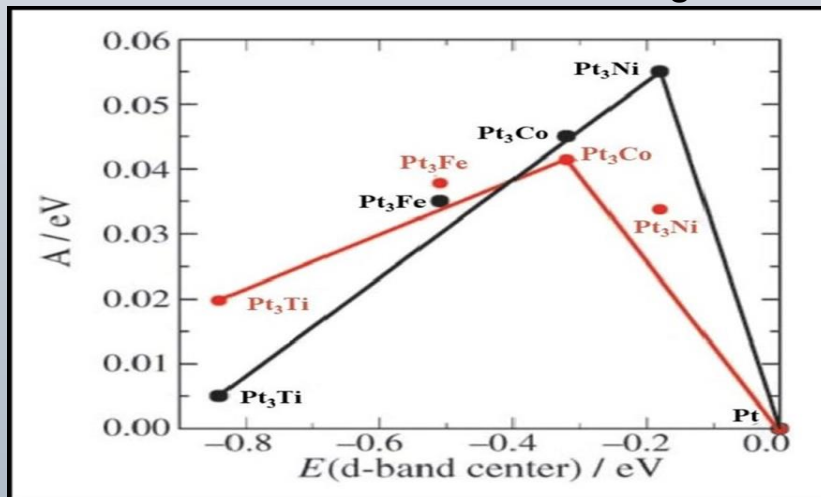
❖ Challenges remain in their commercialization:

- High Pt cost
- Sluggish ORR kinetics



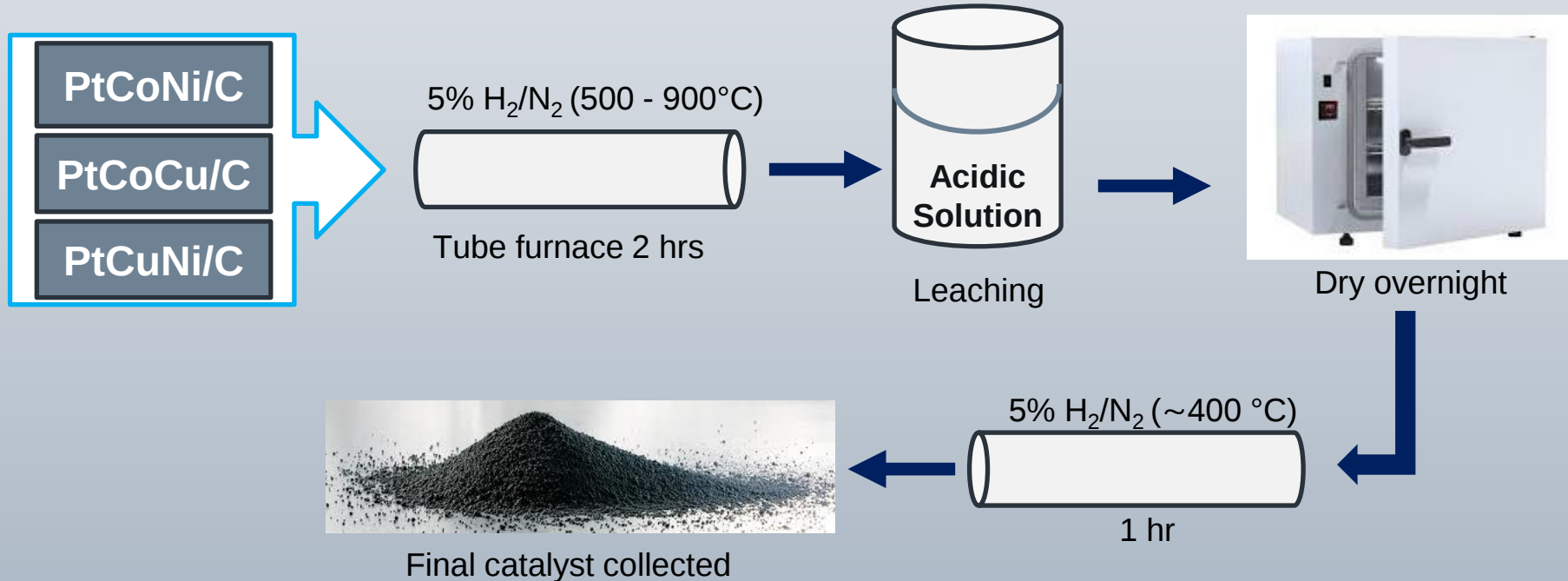
Importance of Reducing Pt Content in PEMFCs Catalysts

- ❖ High Pt cost limits the commercial viability of PEMFCs
 - ↳ Incorporation of non-noble metals on Pt-based alloys
- ❖ Ternary alloys maintain ORR activity and stability while minimizing Pt loading
- ❖ Focus → alloying Pt with Co, Ni, and/or Cu
 - ↳ 22 wt% total metal loading on carbon

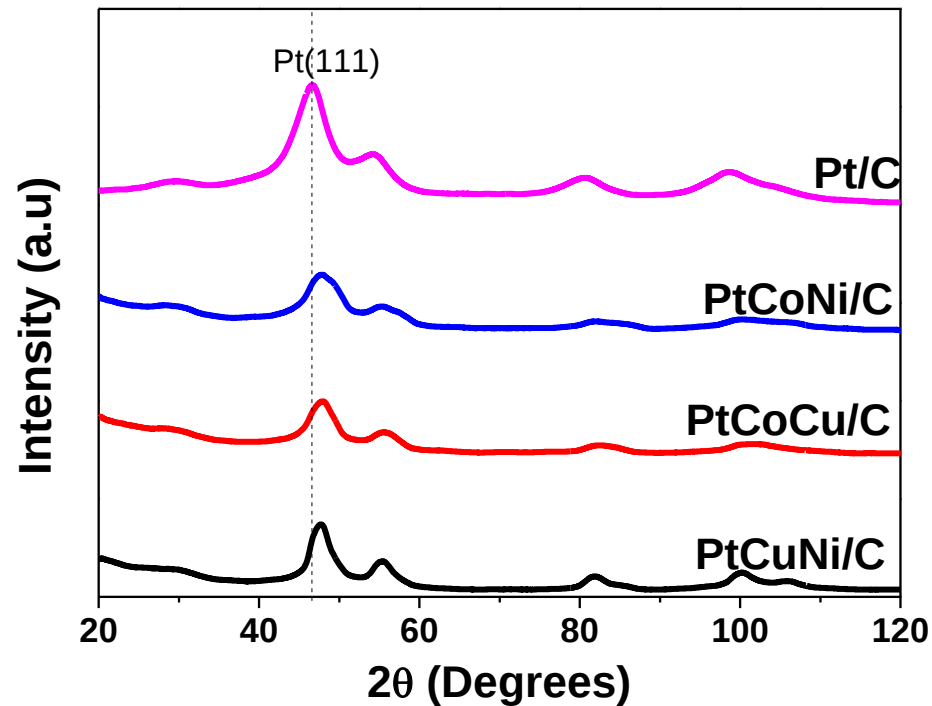


Experimental / Methodology

- ❖ Synthesized three ternary alloy catalysts
 - ↳ Via a modified aqueous deposition chemical reduction technique
 - ↳ Followed by alloying at various temperatures

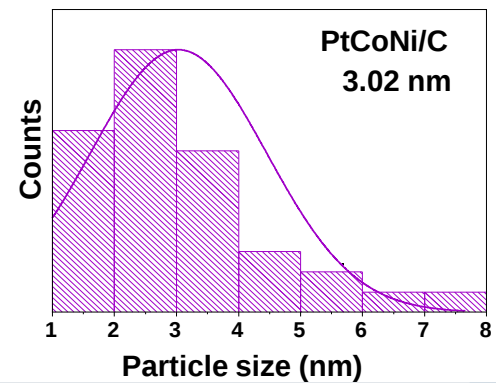
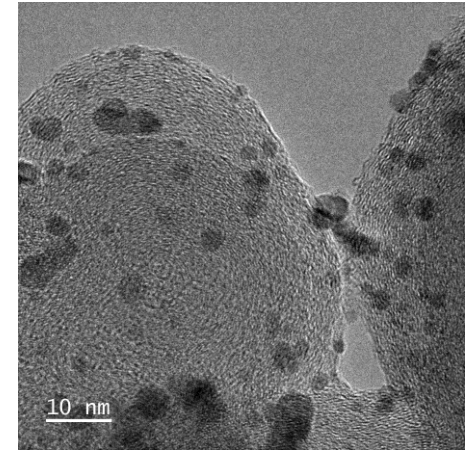
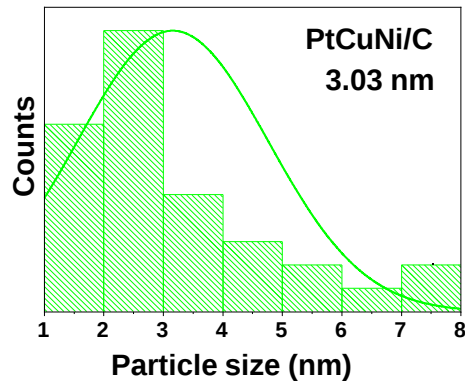
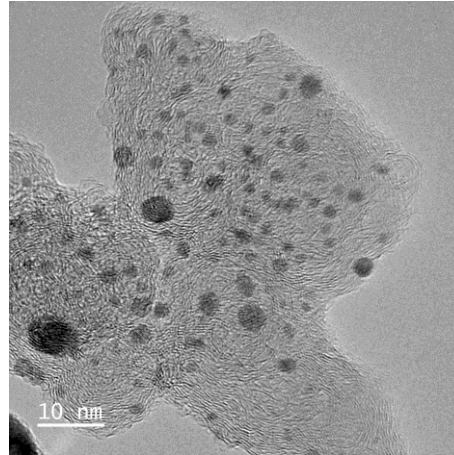
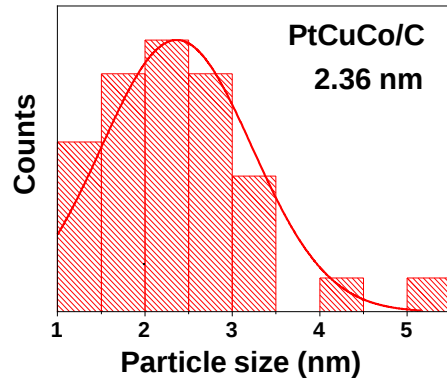
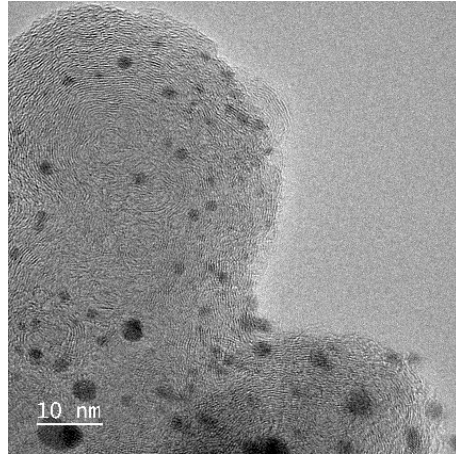


Structural Characterization (XRD)



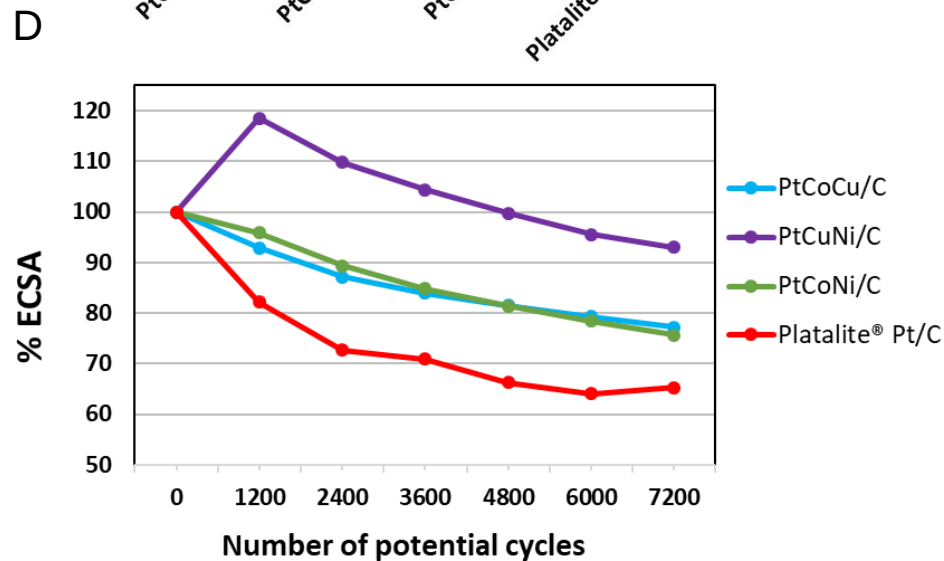
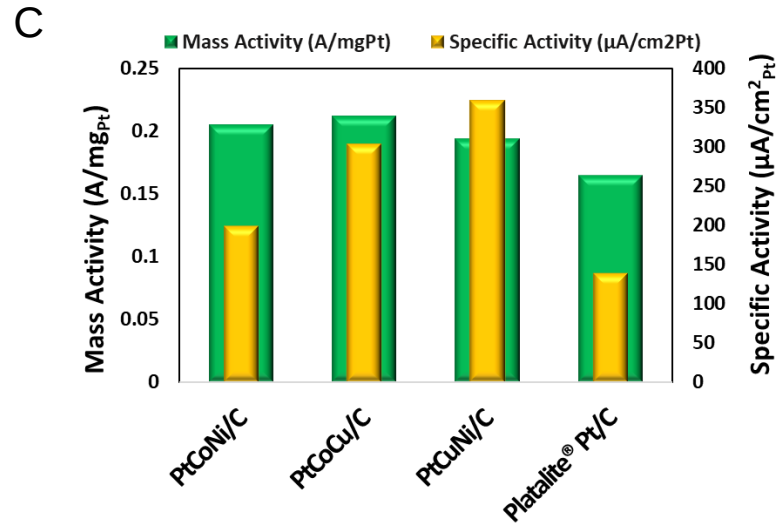
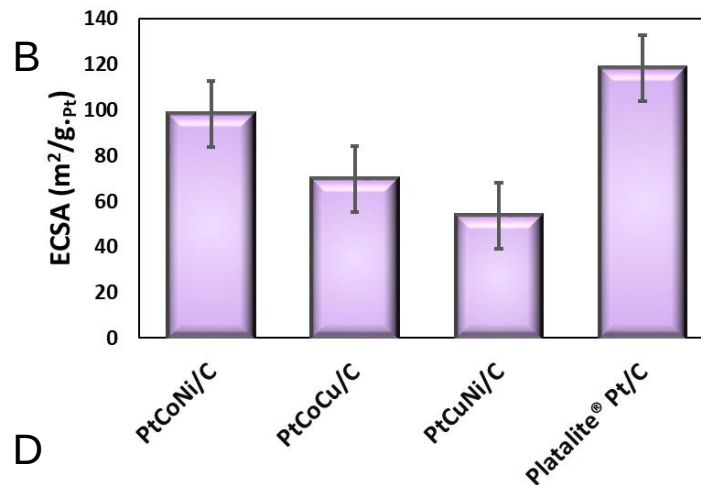
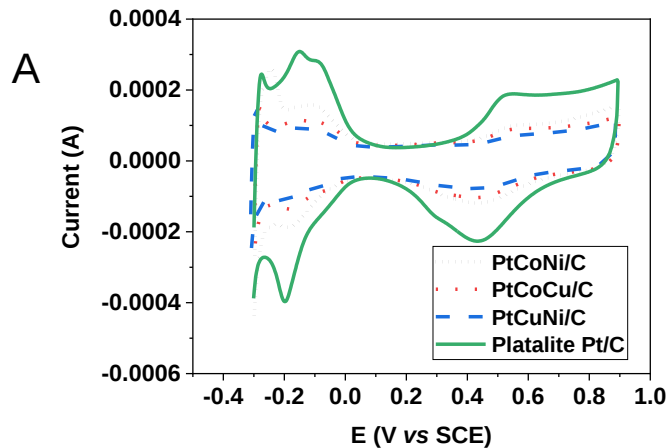
Catalyst	Pt (111) Peak Position (2θ)	Lattice Parameter (Å)	Crystallite Size (nm)
Platalite® Pt/C	46.63	3.92	2.70
PtCoNi/C	47.75	3.83	3.79
PtCoCu/C	47.96	3.81	3.88
PtCuNi/C	47.79	3.83	4.60

Structural Characterization (HRTEM)



Electrochemical Characterization (TF-RDE)

7

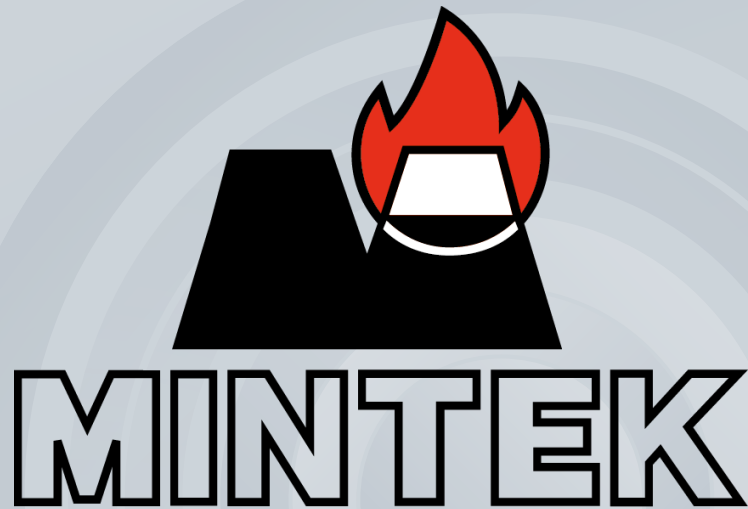


Conclusion

- ❖ Pt-based ternary alloy catalysts synthesized successfully
- ❖ Improved ORR activity
- ❖ From TF-RDE data – average mass activity of PtCoNi/C and PtCoCu/C is 1.2 times higher than that of Platalite® Pt/C
- ❖ Ternary alloys outperform commercially available Platalite® Pt/C catalyst
- ❖ A dependable method to advance catalyst development while reducing cost

Future Work

- ❖ The ternary alloy catalysts will be characterized in-situ as a single cell MEA
- ❖ Upscaling ternary alloys to a larger synthesis scale



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Thank You

ZicabangeleM@mintek.co.za



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Platalite® catalyst enquiries:

Dr Olivia Barron

OliviaB@mintek.co.za



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