Interacting $CoFe_2O_4$ nanoparticles with different Carbon materials for high performance Oxygen Evolution

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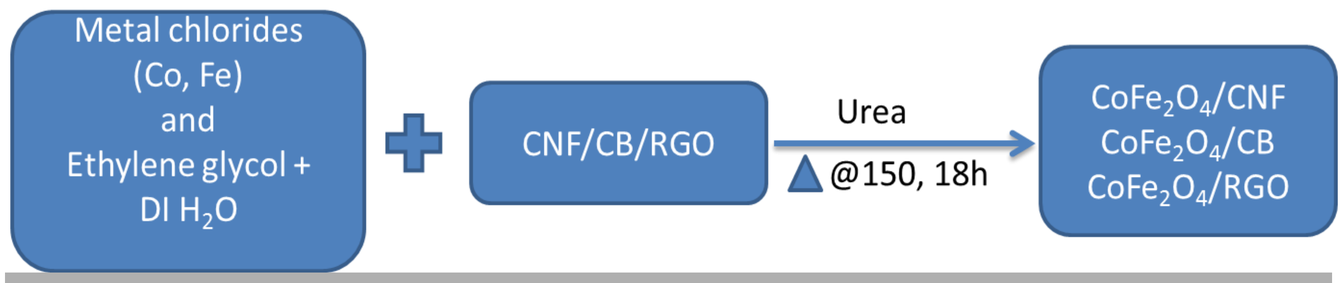
INTRODUCTION

Electrocatalytic oxygen electrochemistry involving the conversion of H_2O into O_2 has attracted considerable attention as a greener process for clean energy generation [1]. However, the oxygen evolution reaction (OER) that facilitates this conversion involves a four electron transfer to produce one molecular oxygen in alkaline medium, leading to large overpotentials [2]. Commercial RuO_2 and IrO_2 have been reported as the state-of-the-art OER electrocatalysts exhibiting lower overpotentials in alkaline electrolytes, but their high cost, scarcity and poor long term stability have hindered their large scale application [1,2]. However, Cobalt ferrite has emerged as the most promising OER electrocatalyst in alkaline conditions due to its high electrocatalytic activity, low cost and good stability [2]. In this study, $CoFe_2O_4$ with various carbon supports (CNF, CB and RGO) have been prepared as electrocatalysts to improve performance of OER in alkaline electrolytes.

EXPERIMENTAL



Scheme 1. Hydrothermal synthesis of $CoFe_2O_4$/CNF, $CoFe_2O_4$/CB and $CoFe_2O_4$/RGO materials.

RESULTS AND DISCUSSION

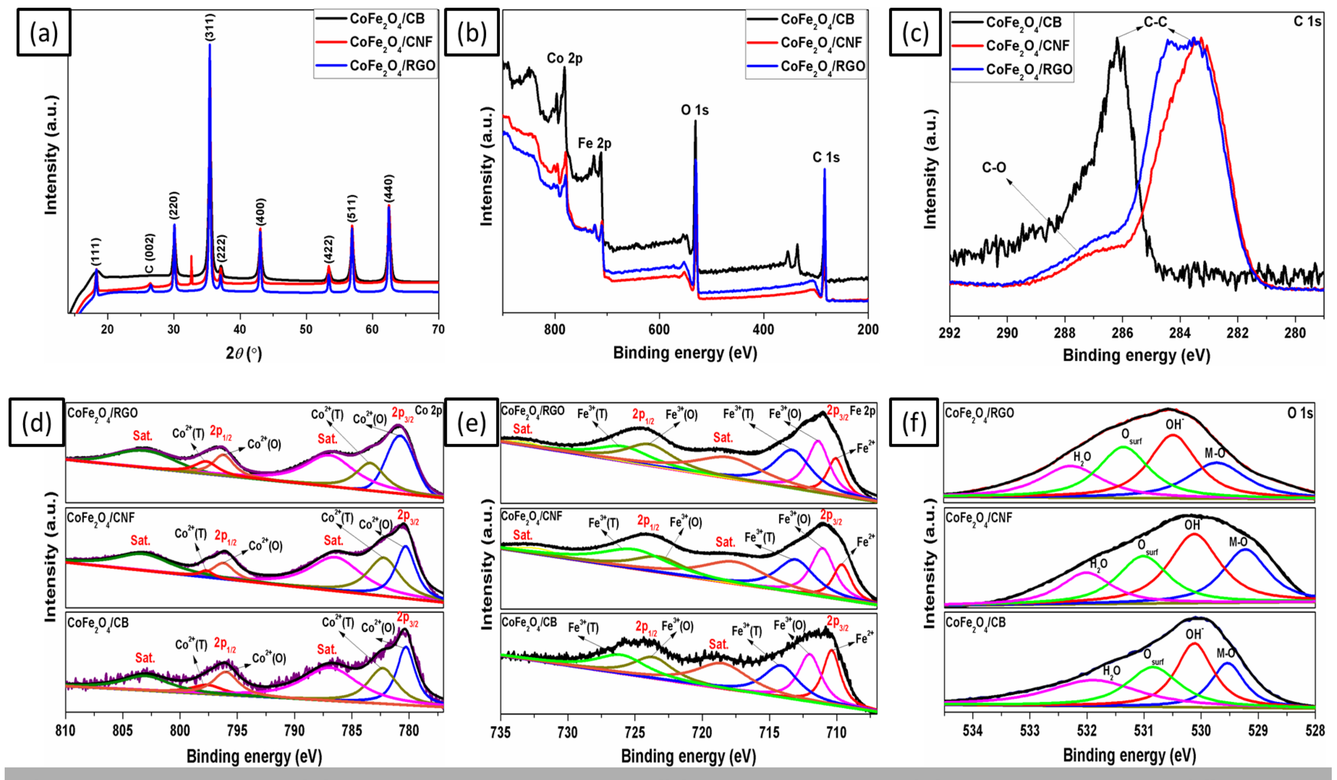


Fig.1. XRD spectra (a); XPS survey spectra (b); C 1s spectra (c); Co 2p spectra (d); Fe 2p spectra (e); O 1s spectra (f), of $CoFe_2O_4$/CNF, $CoFe_2O_4$/CB and $CoFe_2O_4$/RGO materials.

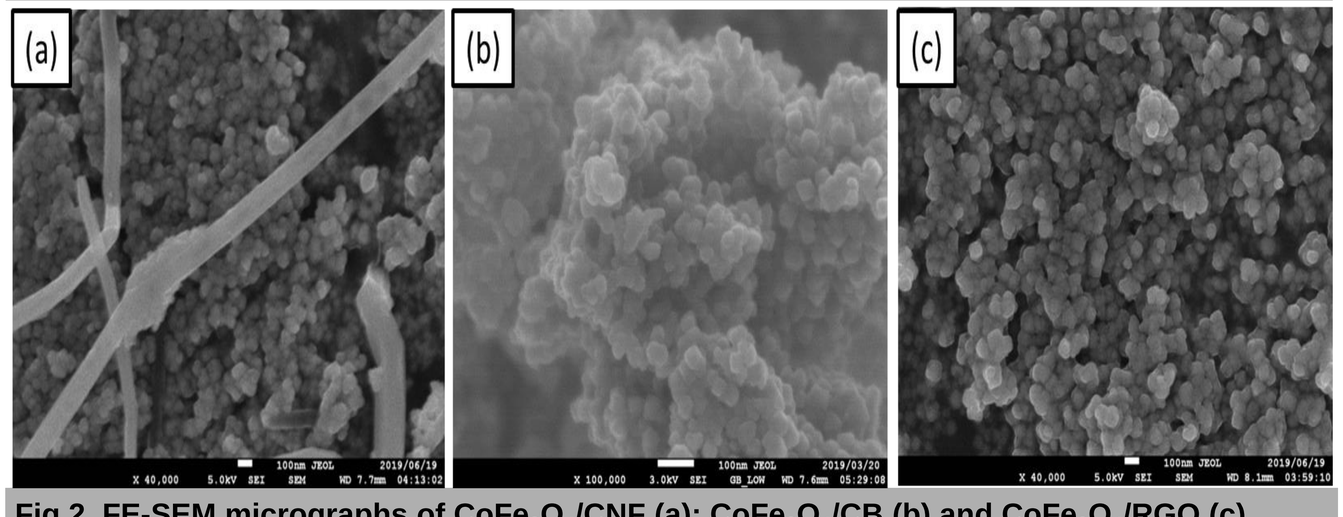


Fig.2. FE-SEM micrographs of $CoFe_2O_4$/CNF (a); $CoFe_2O_4$/CB (b) and $CoFe_2O_4$/RGO (c)

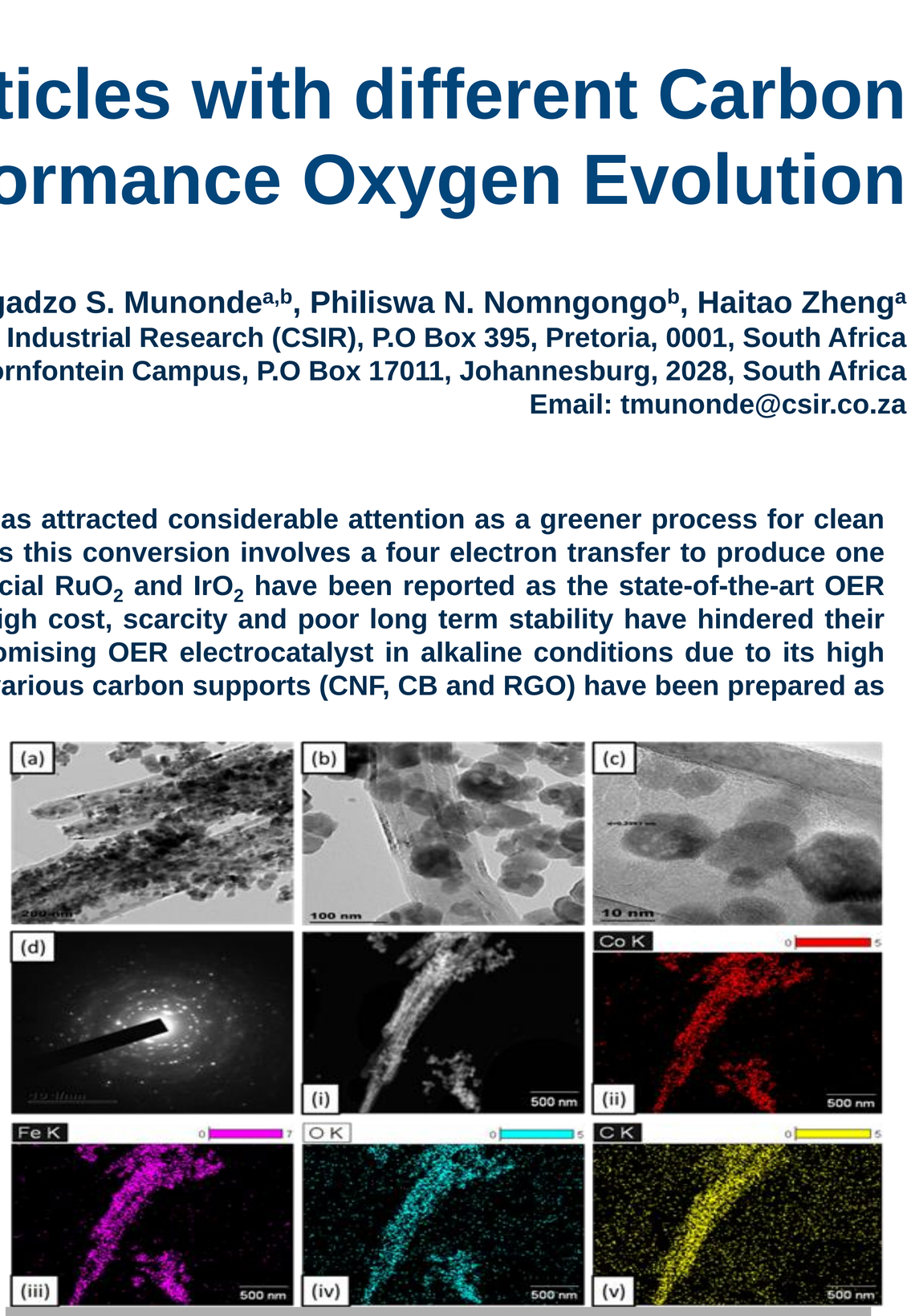


Fig.3. TEM (a, b); HR-TEM (c); SAED (d); Elemental Mapping from (i-v) of $CoFe_2O_4$/CNF

Electrochemical performance

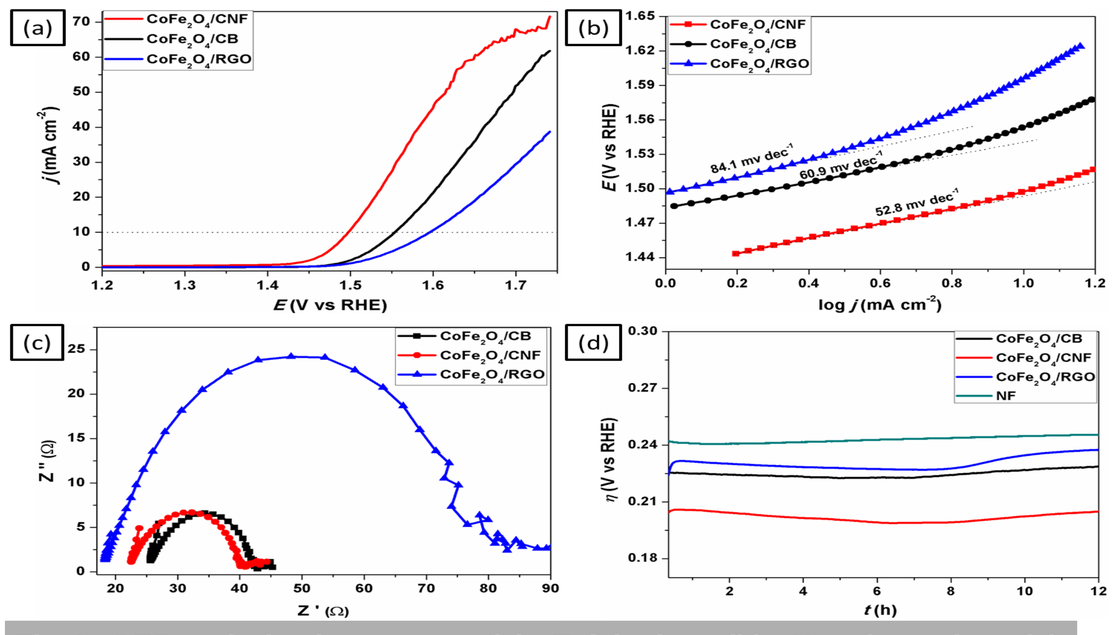


Fig.4. OER polarization curves (a); Tafel plots (b); Nyquists plots (c); Chronopotentiometric curves (d), of $CoFe_2O_4$/CB, $CoFe_2O_4$/RGO and $CoFe_2O_4$/CNF in 1M KOH.

CONCLUSION

We have developed a facile strategy leading to the incorporation of $CoFe_2O_4$ nanoparticles into nanocarbons. Benefiting from the successful grafting of $CoFe_2O_4$ nanoparticles, $CoFe_2O_4$/CNF hybrid displayed excellent OER catalytic activity and stability than its counterpart $CoFe_2O_4$/CB and $CoFe_2O_4$/RGO hybrids.

REFERENCES

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2. A. Grimaud, O. Diaz-Morales, B. Han, W.T. Hong, Y. Lee, L. Giordano, K.A. Stoerzinger, M.T. Koper, Y. Shao-Horn, *Nature chemistry*. 9 (2017) 457.

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