Exploiting Multifunctionality of M^{2+} (M=Co^{2+}, Ni^{2+}) Phosphides for Electrocatalysis toward HER, OER and ORR

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INTRODUCTION

The scarcity and high cost of Pt and Ru/Ir-based noble metal electrocatalysts forces to design alternative low-cost and efficient materials for sustainable energy storage and conversion technologies[1]. Among them, phosphorus-containing coordination polymers, such as metal phosphonates and phosphinates, have emerged as potential precursors of transition-metal phosphide (TMP) electrocatalysts[2].

EXPERIMENTAL STUDY

Pyrolysis under 5%H_2-Ar atmosphere at different temperatures. Electrocatalytic performances were investigated toward Oxygen Evolution Reaction (OER), Oxygen Reduction Reaction (ORR) and Hydrogen Evolution Reaction (HER).

RESULTS AND DISCUSSION

In this research-work, we report the synthesis and crystal structure of several families of divalent metal (Co^{2+}, Ni^{2+}) derived from the (2-carboxyethyl)(phenyl)phosphinic acid (CEPPA)[3] and etidronic acid[4]. These solids were used as precursor of metal phosphides (M_2P/MP) by thermal reduction under 5%H_2-Ar atmosphere at different temperatures and their electrocatalytic performances were investigated toward OER, ORR and HER. The relationship between M/P molar ratios and/or the M^{2+} coordination environment in the precursor structures and the electrocatalytic activity of the prepared metal phosphides will be discussed. The presence/absence of N-doped carbon graphitic matrix in the final materials will be also studied (figure 1)

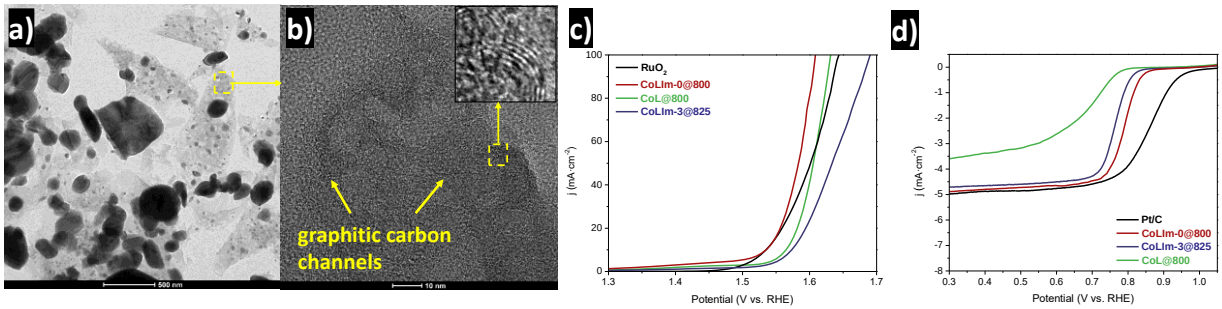

Fig. 1 (a) TEM and (b) HRTEM images of sample **CoLIm-0@800,** derived from etidronic acid, showing metal phosphide particles inside the graphitic carbon matrix. LSV curves of selected TMP for OER (c) and for ORR (d) in 1.0 M KOH.

CONCLUSION

Core-shell electrocatalysts consisting of Co^{2+}-, Ni^{2+}-phosphides particles embedded in a N-doped carbon graphitic matrix exhibited improved catalytic performances compared to the non-N-doped carbon materials.

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