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Development of conductive covalent triazine frameworks: novel metal-free electrodes for the electrocatalytic reduction of CO2

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PURPOSE OF THE ABSTRACT

In recent years, there has been a huge acceleration in the climate change due to the excessive emissions of CO2 from fossil fuel combustion1. For this reason several strategies have been proposed to reduce the CO2 emissions. A widely considered strategy is the conversion of CO2 into fuels or chemical stocks, which is an ideal way to alleviate the environmental problems as this will not only reduce the atmospheric CO2 levels but also decrease the fossil fuel consumption. Since the last 20 years, the electrochemical reduction of CO2 has gained increasing attention to convert CO22. Nevertheless, towards their practical implementation in aqueous media the existing electrocatalysts suffer from one or more of the following problems: poor selectivity due to the competitive H2 evolution side reaction, low electrochemical stability, complicated synthesis and fabrication process, high cost and poisoning of noble metals. Therefore, the development of metal-free catalysts is highly desirable. In this study, we found for the first time the unique ability of N-rich covalent organic frameworks (COFs) to afford an excellent electrocatalytic performance in the CO2 reduction. Hybrid nanostructures were developed in which the N-rich COF materials function as the active sites, while the high electrical conductivity was assured by the functionalized multi-walled carbon nanotubes on which the COF was grown onto (see Figure 1). A Fararadaic efficiency of 90% at -1.0 V vs RHE was obtained for CO which is as high as the current state of the art nitrogen-doped carbon materials demonstrating the great potential of this novel metal-free electrocatalyst

FIGURES

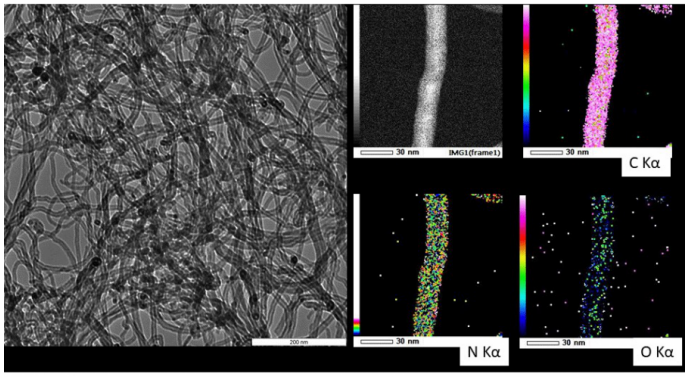

FIGURE 1

Figure 1

(left) HAADF-STEM image of the COF@multi-walled carbon nanotubes, (right) EDX mapping a single COF@multi-walled carbon nanotubes

FIGURE 2

KEYWORDS

electrocatalysis | metal-free | CO2 reduction

BIBLIOGRAPHY

[1] K. Caldeira and M. E. Wickett, Nature, 2003, 425, 365-365

[2] C. Costentin, M. Robert and J. M. Saveant, Chem Soc Rev, 2013, 42, 2423-2436.