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A Ni Single Site carbon based electrocatalyst for the reduction of CO2 to CO

AUTHORS
Karen LEUS / GHENT UNIVERSITY, WARANDE 31, LAARNE

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 combustion. 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 CO21. 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. Recently, single-atom catalysts (SACs) on carbon-supported substrates have been demonstrated as excellent electrocatalysts for a variety of chemical reactions due to their maximum atomic utilization efficiency, unsaturated metal coordination, and good conductivity. In this work, a single atom Ni catalysts was prepared by embedding Ni single sites in a nitrogen rich porous hexa-azatriphenylenetrimethoxytrinitrile (HAT) carbon. The resulting catalyst not only suppressed the hydrogen evolution reaction almost entirely in the potential range of -0.6 V until -1V but also showed high total current densities (up to 65 mA cm-2). In contrast, the pristine support exhibited little activity and selectivity in the CO2 reduction. The low Ni coordination number as well as the high pyridinic N content result in a lowering of the energy barrier for the formation of the COOH* intermediate.

FIGURES

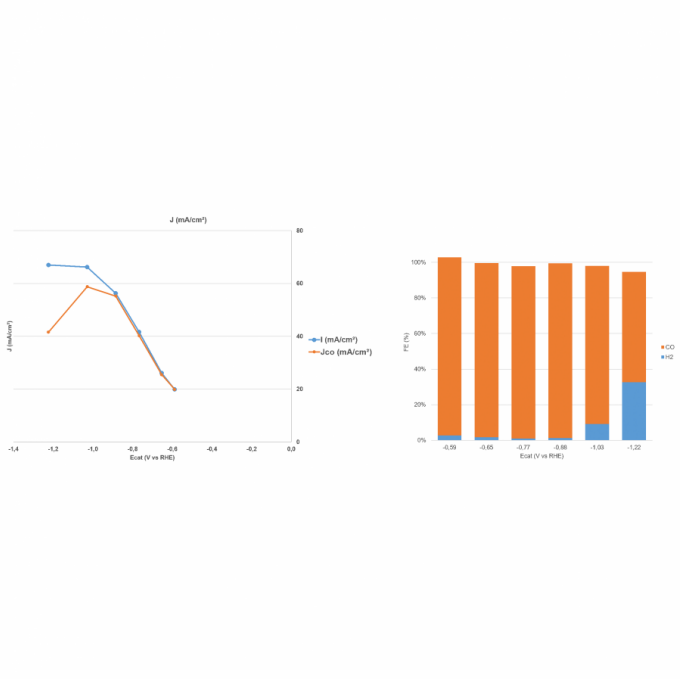

FIGURE 1

Figure (Left) chronoamperometry measurements in the cathodic potentials range (right) Faradaic efficiency of Ni@HAT material in flow-by electrolyzer utilizing 0.5M KHCO3 as catholyte and 2M KOH as anolyte.

FIGURE 2

KEYWORDS

electrocatalysis | single sites | CO2

BIBLIOGRAPHY

1Leus et al. Green Chem., 2020,22, 3095-3103