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Electroreduction of dissolved carbon dioxide on roughened molybdenum microelectrodes
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Abstract
The increasing levels of carbon dioxide (CO2) in the atmosphere may dissolve into the ocean and affect the marine ecosystem. It is crucial to determine the level of dissolved CO2 in the ocean to enable suitable mitigation actions to be carried out. The conventional electrode materials are expensive and susceptible to chloride ion attack. Therefore, there is a need to find suitable alternative materials. This novel study investigates the electrochemical behaviour of dissolved CO2 on roughened molybdenum (Mo) microdisk electrodes, which were mechanically polished using silicon carbide paper. Pits and dents can be seen on the electrode surface as observed using scanning electron microscopy. X-ray diffraction spectra confirm the absence of abrasive materials and the presence of defects on the electrode surface. The electrochemical surface for the roughened electrodes is higher than that for the smoothened electrodes. Our findings show that the roughened electrodes exhibit a significantly higher electrocatalytic activity than the smoothened electrodes for the reduction of dissolved CO2. Our results reveal a linear relationship between the current and square root of scan rate. Furthermore, we demonstrate that saturating the electrolyte solution with CO2 using a bubbling time of just 20 minutes at a flow rate of 5 L min−1 for a 50 mL solution is sufficient. This study provides new insights into the electrochemical behaviour of dissolved CO2 on roughened Mo microdisk electrodes and highlights their potential as a promising material for CO2 reduction and other electrochemical applications. Ultimately, our work contributes to the ongoing efforts to mitigate the effects of climate change and move towards a sustainable future. © 2023 The Royal Society of Chemistry.

Index Keywords
Chlorine compounds, Climate change, Dissolution, Dissolved oxygen, Electrochemical electrodes, Electrolytes, Electrolytic reduction, Microelectrodes, Molybdenum, Molybdenum compounds, Scanning electron microscopy, Silicon carbide; Abrasive materials, Alternative materials, Chloride ion attack, Dissolved carbon dioxide, Electro reduction, Electrochemical behaviors, Electrode material, Electrode surfaces, Microdisk electrodes, X-ray diffraction spectrum; Carbon dioxide

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