

## Highly selective C<sub>2</sub> oxygenates formation from CO<sub>2</sub> electro-conversion with high-density of Cu step-sites catalyst

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Electrochemical CO<sub>2</sub> conversion into valuable C<sub>2</sub> fuel products has been studied intensively since these C<sub>2</sub> products have high energy densities and can be used as a chemical feedstock and a fuel. In this work, we produced highly selective C<sub>2</sub> oxygenates from Cu wrinkle with high density of step-sites using graphene growth process. Resulted Cu wrinkle catalyst showed high C<sub>2</sub> products selectivity achieving 50 % of faradaic efficiency at -0.8 V vs. reversible hydrogen electrode (RHE), which is the largest value compared to previous reports (< ~1% at -0.8 V vs. RHE) before. The partial current density of ethylene glycol was significantly high as -6 mA/cm<sup>2</sup> at -1.2 V (vs. RHE) indicating that suitable productivity value for a practical use. Density functional theory (DFT) calculation results showed that high ethylene glycol productivity was mainly attributed to the (310) facet of wrinkle having a low C-C coupling barrier (0.5 eV) and preferable reaction path toward ethylene glycol (0.02 eV).