## 数据说明

### 一、数据格式说明

例子：{"id": 3540, "data": "Title:Nanostructured Tungstate-Derived Copper for Hydrogen Evolution Reaction and Electroreduction of CO2 in Sodium Hydroxide Solutions\nAbstract:Electroreduction of CO2 became an important topic recently because it can reduce the atmospheric CO2 levels and simultaneously synthesize chemical fuels. However, efficient conversion of CO2 to produce fuels remains a challenge because a proper electrocatalyst is needed to make this CO2 reduction process more selective and efficient. In this study, we prepared nanostructured tungstate-derived copper to test its application in CO2 reduction. The prepared copper tungstate (CuWO4) nanomaterials were first characterized by analytical techniques such as transmission electron microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy to determine the particle size, crystallinity, purity, and composition. Then, the CuWO4 nanomaterials were further investigated in an aqueous solution containing 0.1 M NaOH by electrochemical cyclic voltammetry (CV) and linear sweep voltammetry (LSV) techniques. The CO2 electroreduction experiments were carried out in 0.1 M NaOH with the presence of CO2, and the analysis of electrochemical results shows that nanostructured CuWO4 performs better in comparison with CuO-a well-known electrocatalyst for reducing CO, to nongaseous carbon-containing products such as alcohols-because of poisoning effects of adsorbed CO, or its adsorbed-reduced intermediates on hydrogen evolution reaction. Our results also show that CO2-reduction intermediates adsorbed strongly on the surface of CuWO4, which increases the overpotential for hydrogen evolution reaction on the surface of CuWO 4 by as much as 230 mV against the 70 mV for CuO, at a current density of 0.8 mA cm(-2).\nDoi:10.1021\_acs.jpcc.9b07133", "label": [[508, 523, "structure control"], [621, 626, "CuMOx"], [1304, 1306, "CO"]]}

解释：data表示原始文本数据，label表示实体位置与对应的标签，例如[508, 523, "structure control"] 表示在data中第508-523个字符（包括标点、空格、换行等）nanostructured的标签为tructure control，具体标签涵义将在下面进行解释。

### **样本标签说明**

注：选手可基于标签大类或标签细分类对命名实体进行识别，不同的识别层次会影响最终的判分。

|  |  |  |
| --- | --- | --- |
| **标签大类** | **标签细类** | **解释** |
| **材料种类** | Cu | 铜 |
| Cu/C | 铜/碳复合材料 |
| CuOx | 铜的氧化物 |
| CuSx | 铜的硫化物 |
| CuNx | 铜的氮化物 |
| Cu-M | 铜基双金属材料 |
| CuMOx | M酸铜 |
| Cu-MOF | 铜基金属有机骨架材料 |
| Cu(Ox)-MOx | 铜或铜的氧化物与金属氧化物的复合材料 |
| Cu-molecular complex | 铜基分子配合物 |
| Cu-LDH | 铜与层状双金属氢氧化物的复合材料 |
| CuMSx | 硫代M酸铜 |
| CuPx | 磷化铜 |
| M+CuOx | 金属与铜的氧化物的复合材料 |
| Cu-MXene | 铜与Mxene材料的复合材料 |
| **调控因素** | defect | 缺陷 |
| alloy | 合金 |
| structure control | 结构控制 |
| surface/interface modification | 表/界面调控 |
| atomic level dispersion | 原子尺度分散 |
| composite | 复合化 |
| **产物种类** | CO | 一氧化碳 |
| HCOOH | formate, 甲酸 |
| HCHO | methanal, 甲醛 |
| CH4 | methane, 甲烷 |
| CH3OH | methanol, 甲醇 |
| C2H4 | ethylene, 乙烯 |
| C2H5OH | ethanol, 乙醇 |
| acetone | 丙酮 |
| C2+ | 其他产物 |
| propanel | 丙醇 |
| syngas | H2+CO, 合成气 |
| C2H6 | ethane, 乙烷 |