Supporting information

**Ultra-low Pt decorated NiCu Bimetallic Alloys Nanoparticles Supported on Reduced Graphene Oxide for Electro-oxidation of Methanol**

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**Synthesis of graphene oxide:** The graphene oxide (GO) was prepared by the modified Hummers and Offenmans method. [1] In a typical experiment, 2 g of blank graphite powder was first added into 100 mL concentrated H2SO4 at room temperature. Under stirring, the mixture was cooled to 5 oC using an ice bath, and the temperature of the mixture was kept below 5 oC for 30 minutes. 8 g KMnO4 was then added gradually under stirring and cooling, maintaining the temperature below 10 oC. 100 mL distilled water was added into the mixture, stirred for 1 h, and further diluted to approximately 300 mL with distilled water. After that, 20 mL of 30% H2O2 was added to the mixture to reduce the residual KMnO4. The solid was filtered, washed with 5% HCl aqueous solution to remove metal ions and afterwards with distilled water until the pH was 6. The resulting graphene oxide was dried at 50 oC for 24 h.

**Reference**

1. W.S. Hummers, R.E. Offeman, Preparation of Graphitic Oxide. *J. Am. Chem. Soc.* 80, 1339 (1958).

**Table S1:** ICP-MS results for real Pt, Ni and Cu loading measurements of all the catalysts included in present study

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| --- | --- | --- |
| **No.**  | **Catalyst** | **ICP-MS measurements**  |
| **Pt****(mol)** | **Ni****(mol)** | **Cu****(mol)** | **Pt****(wt%)** | **Ni****(wt%)** | **Cu****(wt%)** | **Pt****(wt%)** | **Ni****(wt%)** | **Cu****(wt%)** |
| **“Actual Loadings”** | **“Nominal Loadings”** |
| 1 | Pt-Ni1Cu3/rGO | 2.185×10-6 | 0.002×10-3 | 0.0168×10-3 | 1.93 | 59.4 | 18.9 | 2 | 20 | 60 |
| 2 | Pt-Ni1Cu1/rGO | 2.211×10-6 | 0.005×10-3 | 0.0145×10-3 | 1.96 | 38.9 | 39.3 | 2 | 40 | 40 |
| 3 | Pt-Ni3Cu1/rGO | 2.204×10-6 | 0.008×10-3 | 0.0119×10-3 | 1.98 | 19.7 | 58.8 | 2 | 60 | 20 |



**Figure S1:** Electrochemical CV results taken in presence and absence of Pt loading in 0.1M KOH + 1 M CH3OH, for the analysis of electrocatalytic MOR performance of Ni1Cu3/rGO and Pt-Ni1Cu3/rGO catalysts.