

## Electrochemical reduction of CO<sub>2</sub> in aqueous cetyltrimethylammonium bromide solutions

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According to the latest report, the concentration of CO<sub>2</sub> in the atmosphere is approximately 395 ppm and is 45 ppm higher than the upper safety level (350 ppm). Anthropogenic CO<sub>2</sub> emission contributes around 3.9% increment to the natural carbon cycle per year and at the current rates of emission, it is predicted that the concentration of CO<sub>2</sub> will reach 500 ppm within 4 decades [1]. Increase in the concentration of CO<sub>2</sub> in the atmosphere will result in series environmental effects such as global warming and Ocean acidification.

On the other hand CO<sub>2</sub> is a most abundant and cheapest C1 feed stock for organic compounds. Converting CO<sub>2</sub> to useful organic compounds is one of the promising methods to reduce the CO<sub>2</sub> concentration [2]. Electrochemical reduction of CO<sub>2</sub> is the easiest way to produce useful product under mild conditions. Last two decades large number of work reported on the same field. Various metals, metal-organic frameworks, metal complexes and different electrolytes are used to study the electrochemical reduction of CO<sub>2</sub>. [3]

In the present work, we studied the CO<sub>2</sub> reduction in aqueous solutions of cetyltrimethylammonium bromide (CTAB) on polycrystalline gold electrode. Figure (1.a) shows the cathodic polarization curve of CO<sub>2</sub> reduction in CTAB solution at the scan rate of 50mV/second in de-aerated CTAB solutions with and without dissolved CO<sub>2</sub>. Depending on the concentration of CTAB used, we observed differences in activities: (a) at [CTAB] < critical micelle concentration (CMC), there is no appreciable current corresponding to CO<sub>2</sub> reduction; (b) at [CTAB] > CMC, increment in current as well as shift in potential to more anodic is observed depending on the concentration (from 10 mM to 40 mM) Fig.(1b). These results suggest that the concentration of the CTAB plays a decisive role in the reduction of CO<sub>2</sub> which could be due to increased solubilization of CO<sub>2</sub>. Of the several concentrations used, 40 mM seems to be optimum for CO<sub>2</sub> reduction with the ~ 30 mV shift of E<sub>1/2</sub> to more anodic comparing with 10 mM. Generally, CO is the most common product in aqueous solution on polycrystalline gold electrode [4-5]. Interestingly, however, we observed (i) no surface blocking of Au by CO and in addition, (ii) the carbonyl stretching frequency at ~ 1734 cm<sup>-1</sup> thus confirming the possibility of formation of some other organic product(s). Detailed product analysis is underway to

find the product distribution, which will shed light on the complex mechanistic details of CO<sub>2</sub> reduction in CTAB solutions.

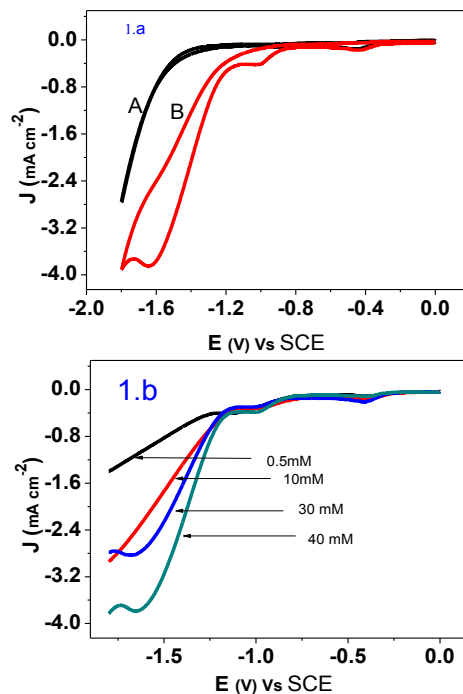


Fig.1. (a) Cathodic polarization curve of CO<sub>2</sub> reduction in 40 mM CTAB solution: (A) saturated with Ar, (B) after saturating with CO<sub>2</sub>. (b) voltammetry of CO<sub>2</sub> reduction in CTAB solution of different concentrations

### References

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