Section 4

Application Perspectives of Solid State Electrochemical Devices: Fuel Cells, Li-ion Batteries, Supercapacitors, Sensors, etc.

INVITED
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REPORTS

I-18. ELECTRO-CATALYTIC REFORMATION OF CO_2: CATALYSTS FOR $CO_2 \rightarrow C_2H_4$ REACTION PROMOTION

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The rapidly increasing deployment of technologies to harvest power from wind and sun offers great potential of "green electricity" as the driving force for CO_2 conversion P2X (power-to-fuel). More is being researched the catalytic conversion of CO_2 with "green" hydrogen from water electrolysis, compare to the direct electrochemical CO_2 conversion. The electro-catalytic reformation of CO_2 exhauts to fuel is considered an important potential contribution to future developments in the industry reducing greenhouse gas emissions and establishing closed carbon cycles for sustainable development. CO_2 is available in large quantities and sufficient purities from various sources at moderate to low costs.

The main conceptual approaches can be summarized as electrocatalytic direct conversion of CO_2 and H_2O to C1(metane, formic acid, formaldehyde, methanol or methane) and more complex hydrocarbons under C-C bond formation (ethylene, acethylene, ethanole etc). For the development of catalytic materials, researchers have sought to improve their performance with various strategies, such as nanostructuring, surface functionalization, alloying and more, thereby fixing the catalytic metals on an electrically conductive carrier, usually on the nanostructured porous carbon materials.

In this paper it was shown, that the adhesion of Cu films on graphene sheet stacks (GSS) can be improved with nitrogen doping. N-GSS/Cu catalyst layer tests in stationary electrolyte cell with 1M $KHCO_3$ electrolyte with 150 mA/cm^2 during 60 min (gas sampling time – 30 min) showed the presence of ethylene in high concentration – around 2 vol% (FE~27%). Performed calculations from first principles showed that graphene covered by nitrogen strengths the Cu cluster adsorption due to more covalent nature of Cu-N-C bond with respect to Cu-C bond. Nitrogen does not influence to CO_2 adsorption at Cu7 cluster. For the moment we calculate predictions of the CH_2-CH_2 dimerization mechanism at Cu7/graphene and formation of C_2H_4.

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