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Optimizing the Structural and Morphological Parameters of Copper and Copper Oxide Nanostructures for Electrochemical Reduction of CO_2

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The electrochemical reduction of CO_2 into valuable compounds that can be used as the starting material for the production of fine chemicals can be the potential strategy to utilize this molecule of high environmental impact. Amongst the reported electro-catalytic materials for the reduction of CO_2, copper/copper oxide (Cu/Cu_2O) electrodes have been special in its catalytic conversion activities but yet their use at an industrial scale is far from the practice. However, understanding its unique ability to catalyze the hydrocarbon formation would be highly encouraging for the design of new active catalysts with better product selectivity and thus, deserve further investigation for its optimization through shape, composition and morphology. Here, we report our successful strategy for the optimization of an electro-catalyst based on dendritic shaped Cu nanoparticles (NPs) and Cu_2O-rGO composite prepared by rudimentary simple and green electrochemical dissolution method. The morphology, crystallinity and composition of the dendrites are found to be strongly correlated with their electro-catalytic CO_2 conversion activity. Moreover, the growth pattern of the Cu and Cu_2O-rGO NPs was studied rigorously and an evolution of dendritic shapes have been optimized with respect to several electrolysis parameters viz. applied bias voltage, additives concentration (i.e. L-ascorbic acid and tri-sodium citrate) and electrolysis time and temperature.

Biography:

Dr. Pravin P. Ingole has been trained in electrochemistry and has been working in this domain for more than 10 years. His research interests include electrochemical investigations of nanophase materials for energy and environmental applications. This has included developing electro-catalytic materials for carbon dioxide reduction, oxygen reduction reactions which is one of the most important components of alkaline fuel cells and photo-electrochemical water splitting for the generation of hydrogen and oxygen.

Recently, his research group has started working on super-capacitor applications where different metal oxide nanoparticles have been coupled with carbon nanostructures to enhance their capacitance values.