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Advances in Electrochemical Reduction of CO_2 in Ionic Liquid-Based Electrolytes

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Abstract: Electrochemical reduction of CO_2 was for the first time reported in 1870 [1], but it was only after 2010 that this field was the subject of intense research efforts. The use of renewable electricity to convert CO_2 into products that are currently derived from fossil products and have high carbon footprint will certainly make this technology one pillar of a sustainable chemical industry. The scepticism towards the availability of cost effective products derived from CO_2 electro-reduction that customers will be willing to buy has shifted to the belief that they can be commercially viable. Turning electrochemical CO_2 reduction into a commercial technology will depend on economics, on the price of electricity, efficiency of the process and the value of the products. One way to improve the economics and improve the efficiency of the process is to integrate CO_2 capture with conversion [2,3]. In this way the energy intensive regeneration step of the capture media can be eliminated and also CO_2 transportation and storage. Ionic liquids are ideal media to achieve this integration, due to high CO_2 adsorption capacity, high selectivity, wide electrochemical windows and nearly zero vapour pressure. The present work reports the progress of electrochemical reduction of CO_2 in ionic liquids and the work of the authors in this field. It has been recognized that ionic liquids promote CO_2 electro-reduction through lowering the reduction potential, the suppression of the competing hydrogen evolution reaction and by increasing the selectivity towards the target products. However, the understanding of the interactions between ionic liquids, CO_2 and catalyst is still quite limited, but fundamental for synthetizing more efficient electrolytes for CO_2 electro-reduction [4]. Thus, current cation and anion effects will be analysed and an overview of the current performance of heterogeneous electro-catalysts in ionic liquid- based electrolytes for CO_2 electro-reduction will be provided.

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Biography of presenting author

Ana Reis Machado is a Senior Researcher of the Chemistry Department of the Nova School of Science and Technology. She graduated from Inst. Superior Técnico, Portugal in Chemical Engineering, obtained a PhD degree in Chemistry from UNL and concluded a MBA from the Portuguese Catholic University. She worked for more than 15 years in R&D in companies. She is co-inventor of several patents in different scientific fields. Her current main scientific interests are in the field of Green Chemistry, in particular in CO_2 utilization, functional materials, energy storage systems, electrochemistry, ionic liquids and sustainable separations processes including supercritical fluid technologies.