Harmful CO_2 is converted into useful chemicals using an earth-abundant metal containing catalyst

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Carbon dioxide (CO_2) is one of the major contributors to greenhouse gases. An increase in the CO_2 level in the atmosphere causes global warming resulting in unpredicted climate change. One of the ways to reduce this is to capture them efficiently and convert to value-added chemicals. In fact, CO_2 is quite useful in the preparation of many chemicals like salicylic acid (for making aspirin), ethanol (solvent, sanitizer), dimethylcarbonate (fuel), etc. Among various value-added chemicals, cyclic carbonates are interesting due to their widespread use in batteries, as high boiling solvents, and as a precursor for plastic bottles. However, CO_2 being a thermodynamically more stable molecule, chemical reactions involving CO_2 possess a high activation barrier. Thus, the use of catalysts is indispensable for the successful conversion of CO_2 into the above mentioned chemicals. Despite the availability of several catalysts, the development of earth-abundant metal-based catalysts is challenging. Our objective is to use diaspor (AlOOH) and perform reactions at milder and sustainable conditions like atmospheric pressure, solvent and less toxic chemicals. Diaspore, in the presence of a small amount of dimethyl formamide, is able to convert a range of epoxides into their corresponding cyclic carbonates. Hardly any loss in the catalytic activity or change in the functional/chemical characteristics of the diaspore was observed after five cycles. DFT calculations reveal the spontaneity of the diaspore-catalyzed cycloaddition reaction compared to that of the diaspore-free reaction.

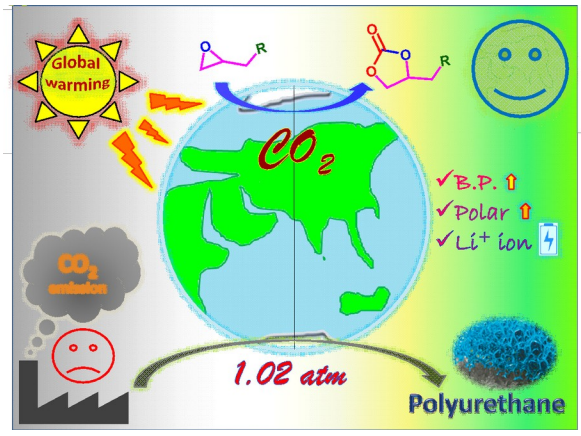

Figure: Schematic illustration of the harmful effects of CO_2 and how it can be converted into useful chemicals like cyclic carbonates from epoxides (Ref: Antarip et al., *Inorg. Chem. Front.*, 2023, 10, 6329)