PLASMA-ASSISTED CO_2 RECYCLING: INVESTIGATION ON VOLUME AND SURFACE KINETICS

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The development of green technologies that accelerate the transition towards a more sustainable and resilient world with zero net emissions by 2050 requires long-term and large-scale energy storage solutions. A promising and environmentally friendly solution to this problem relies on the development of a suitable energy storage scheme in which the excess of renewable power is used to convert feedstock of pollutant gases such as CO_2 into chemical fuels. In this context, over the past years, non-thermal plasmas have gained much attention regarding CO_2 decomposition due to their potential to activate CO_2 at reduced energy cost, while exciting CO_2 vibrations that efficiently contribute to overcome the dissociation barrier. This has led to a growing field of research aimed at combining renewable electricity with plasmas to convert pollutant gases into synthetic fuels for energy storage pathways.

In this talk, I will provide an overview of recent research associated to plasma-based conversion, while discussing different lines of investigation and current challenges related to plasma-surface interactions. More specifically, I will address: (i) the role of industrial gases on CO_2 decomposition in a plasma environment, (ii) the impact of volume and surface kinetics on vibrational excitation and (iii) recent efforts targeted at developing plasma-based reaction mechanisms to account for the volume/surface production of value-added products in gas reforming applications. In all these situations, modelling studies, based on the coupling of the electron Boltzmann equation with a system of rate balance equations, are compared against experimental data obtained in different plasma reactors, including DC glow discharges and inductive coupled plasmas.

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