METHODS AND SYSTEMS FOR AUTOMATED OPTIMIZATION OF CO_X ELECTROLYSIS REACTOR

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Patent Application No. 17/403,453, filed on August 16, 2021.

BACKGROUND

[0002] Carbon dioxide (CO_2) accumulation in the atmosphere is a major culprit in global warming. Capturing it at emitting point sources or directly from the air (through direct air capture) and converting it into valuable chemicals and fuels using a decarbonized source of electricity is a promising way to both reduce its atmospheric concentration and offer sustainable alternatives to current fossil-fuel-derived feedstocks. Among the envisioned conversion technologies, polymer-electrolyte-membrane-based electroreduction technology stands out by its versatility (possible use at a wide range of temperatures and pressures, possible intermittent use) and amenability to generate a wide range of products.

[0003] Electroreduction of CO_2 has been reported to produce carbon monoxide (CO), formic acid, ethylene, ethanol, ethane, propanol, propylene, acetaldehyde among other products. Potential of this technology has been covered by several reviews. Electroreduction of bicarbonate and carbonate ions (HCO_3^- and CO_3^{2-}), in which CO_2 favorably evolves in a low (respectively high) alkalinity aqueous solution, are also being explored. This is of particular interest as major CO_2 capture technologies involve contacting CO_2 with alkaline aqueous solutions to form such bicarbonate and carbonate-containing compounds, that have limited added value as such. Finally, an increasing attention is drawn to CO electroreduction. Coupled with a first step ensuring the conversion of CO_2 into CO (by any means such as but not limited to electroreduction, hydrogenation of CO_2 or gasification of carbon-containing feedstocks such as but not limited to waste, biomass), CO electroreduction has been reported as a potential economically viable means to produce certain commodities such as ethylene. Electroreduction of CO and N-containing reactants such as but not limited to NH_3, NO_2 and NO_3^- is also of major interest to reinvent industrial chemical processes involving the creation of C-N bonds.