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Autothermal Direct Air Capture System for Carbon Dioxide

-Potential Applications • CO₂ capture from ambient air • CO₂ concentration for industrial use Benefits and Advantages • Lower operating costs due to self-heating process • Process requires only air, water, and electrical energy as inputs • Fully contained from capture through concentration/compression

Invention Description Research at Arizona State University has led to the development of an autothermal CO₂ process that delivers concentrated, nearly pure CO₂ from captured dilute CO₂. Central to this innovation is a sorbent filter that releases water when exposed to ambient air during the CO₂ capture stage, and then also absorbs water during the sorbent regeneration stage. The heat released from the sorbent during water absorption in the regeneration stage is used for steam generation to further hydrate the sorbent material, resulting in a self-amplifying effect. Thus, the process relies heavily on internally generated heat for the evaporation of water and the increase in system temperature. Operating costs for such an autothermal process can be much lower than for capture processes that use other energy sources to supply heat. Background Capturing carbon dioxide (CO₂) from air or other dilute sources is fundamental to combating climate change by reducing CO₂ concentration in the atmosphere. Additionally, advancements in purification and concentration of captured CO₂ can add economic value to industrial markets using carbon as an input. However, until the operating expenses (especially energy costs) associated with CO₂ processing become less prohibitive, carbon-processing industries will continue to look toward other carbon sources. [Faculty Profile of Professor Klaus Lackner](#)

