

Hydrotalcite 계열 물질을 이용한 CO₂ 흡착

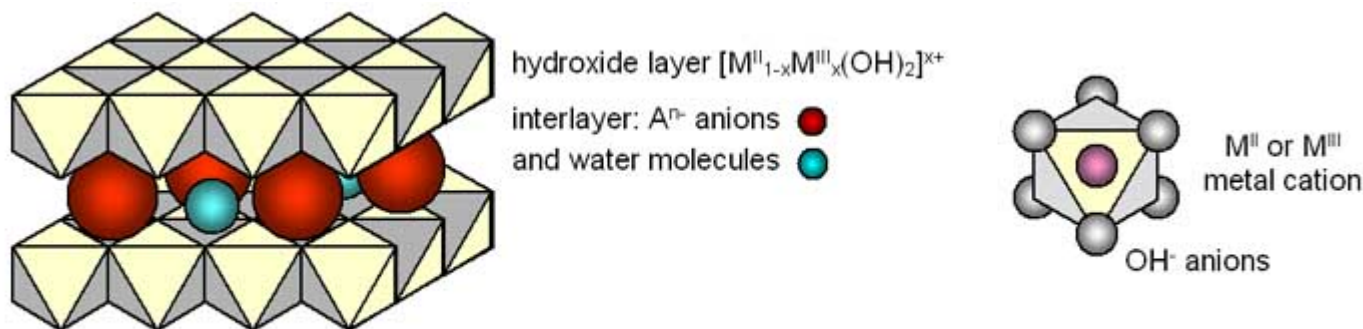


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What is hydrotalcite ?

Anionic and basic clays, also known as layered double hydroxide (LDH) ; positively charged brucite-like $(\text{Mg}(\text{OH})_2)$ layers with trivalent cations substituting for divalent cations. The excess positive charge is compensated by by anions and water molecules. Mesoporous material with slit-like structure and shows type-II N_2 adsorption isotherm.



Layered crystal structure of hydrotalcite-like compounds

Sorption enhanced reaction(SER) & PSA

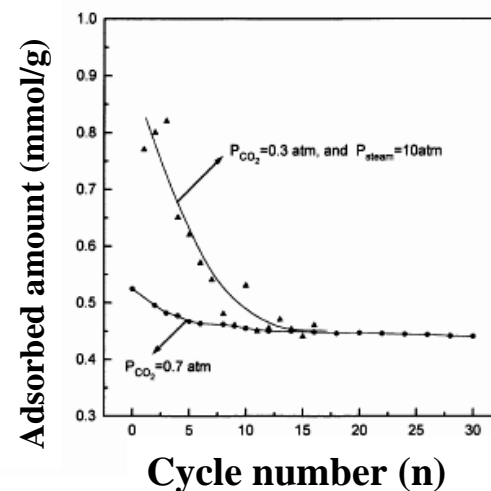
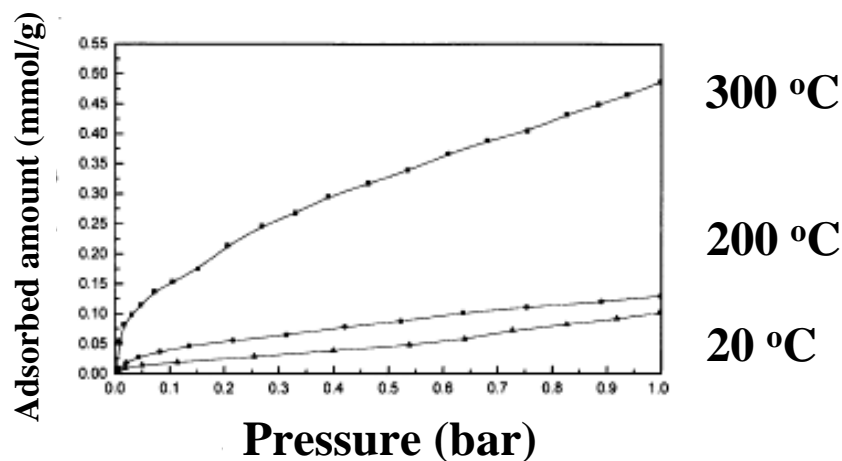
- The K_2CO_3 -promoted hydrotalcite has attracted considerable attention because it has been used for high purity H_2 production by low temperature (673-773 K) steam-methane reforming(SMR).
- CaO or dolomite (CaO . MgO) is also used for the same purpose.
- A PSA-based concept called SER is developed that simultaneously carries out the equilibrium-controlled SMR reaction ($\text{CH}_4 + 2\text{H}_2\text{O} \rightarrow \text{CO}_2 + 4\text{H}_2$) and selectively removes CO_2 from the reaction zone to circumvent the thermodynamic limitation of the reaction by Le Chatelier's principle.
- Sorption-enhanced water gas shift reaction is the same kind ($\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$)

Generally reported facts about hydrotalcite

- **Mg-Al talcite system is better than others (623 K pre-treatment) in PSA process at relatively high temperature (473-673 K). K_2CO_3 promoted system shows enhancement in performance.**
- **Optimum Al content exists (As Al increases, the layer charge increases and interlayer space decreases).**
- **Anionic species affect the interlayer void space and the higher the interlayer space more CO_2 would be accommodated. More negatively charged anions are better for CO_2 adsorption as well.**
- **Water or steam favors CO_2 adsorption especially at low P (0.05 BAR) condition.**

Generally reported facts about hydrotalcite

- Very dependent on materials prepared by individuals.
- Amount adsorbed changed abruptly on pressure and sometimes shows non-linear dependence on temperature.
- Repeated cycles show continuous drop in the CO₂ amount adsorbed due to irreversibly chemisorbed species.



References

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