

2020 X-TWICE 실전문제연구단

Difference of ethylene production by controlling surface morphology of acid catalyst

산 촉매의 표면 형상 변화에 따른 에틸렌 생성 반응 활성 변화

TEAM: P2G

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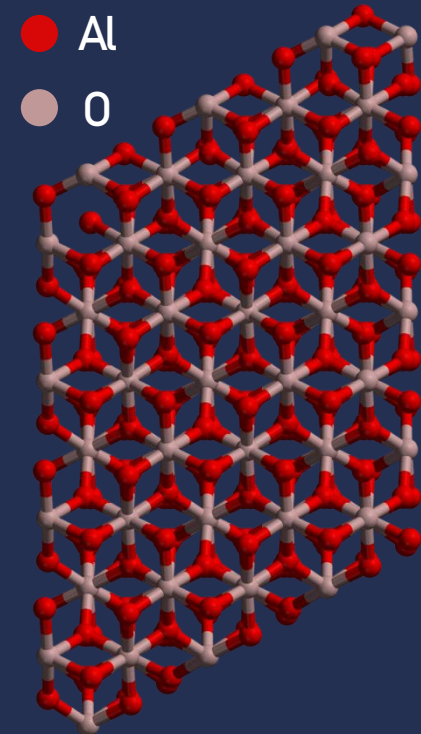
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Objectives

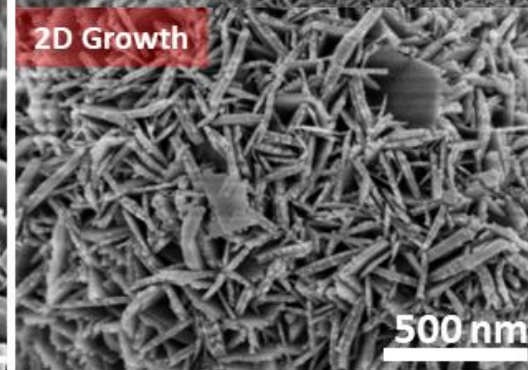
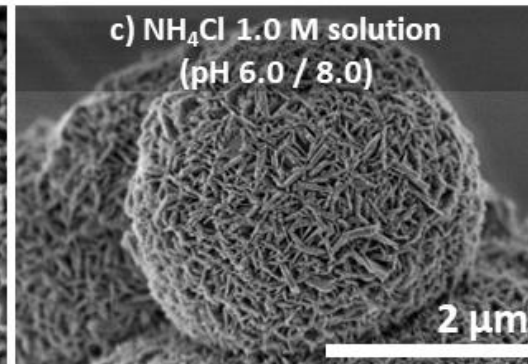
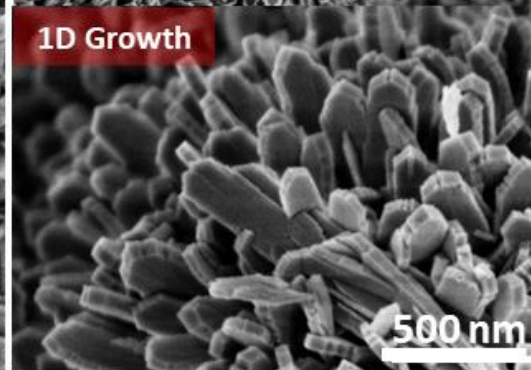
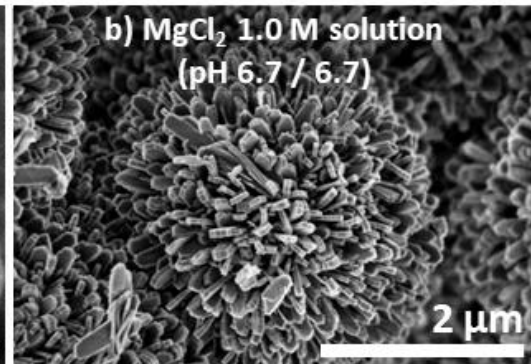
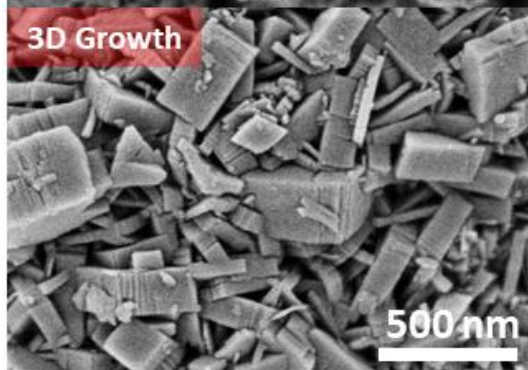
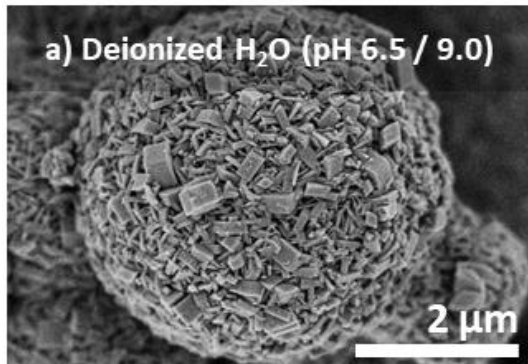
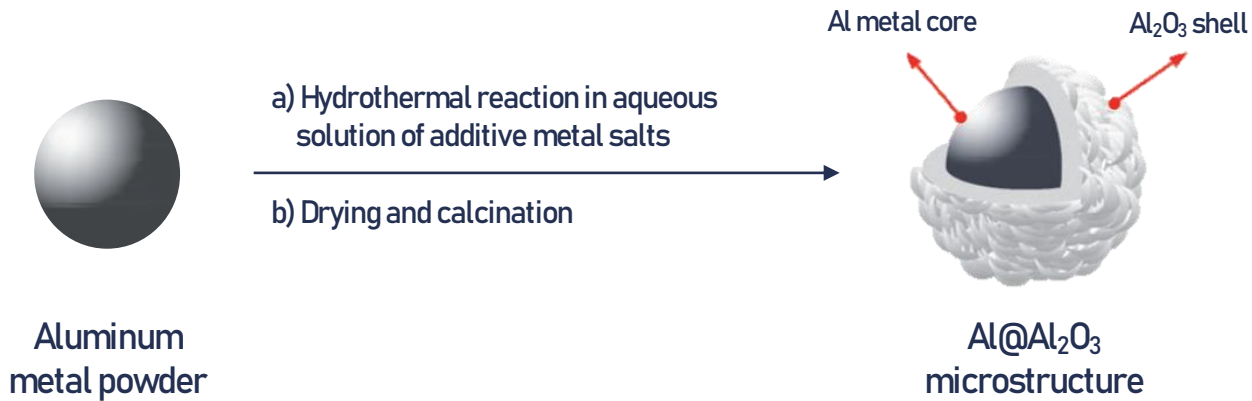
- An important catalytic material that has been used as a support.
- it can participate in acid-catalyzed reactions.
- Boehmite, is a precursor of alumina, is changed its morphologies depending on pH, temperature and additives.
- According to changing of alumina morphology, the acidity can be changed.
- The active metal of heterogeneous catalysts can differently interact with the alumina support having other acidity.

→ Manufacturing highly efficient catalysts



Alumina (Al₂O₃)

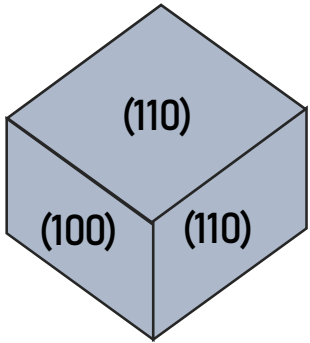
Results and discussion ① Synthesis of Al@Al₂O₃ with controlling morphology



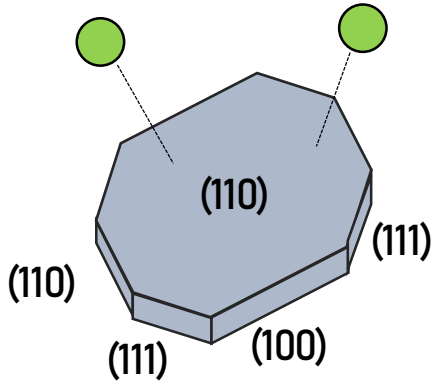
Good properties for
➤ **Heat transfer**
&
Mass transfer

Results and discussion ② Relation between acidity and crystal facet

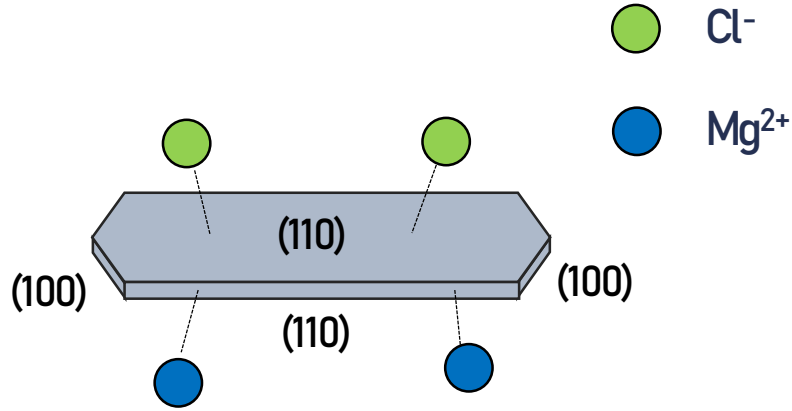
3D Growth



2D Growth



1D Growth

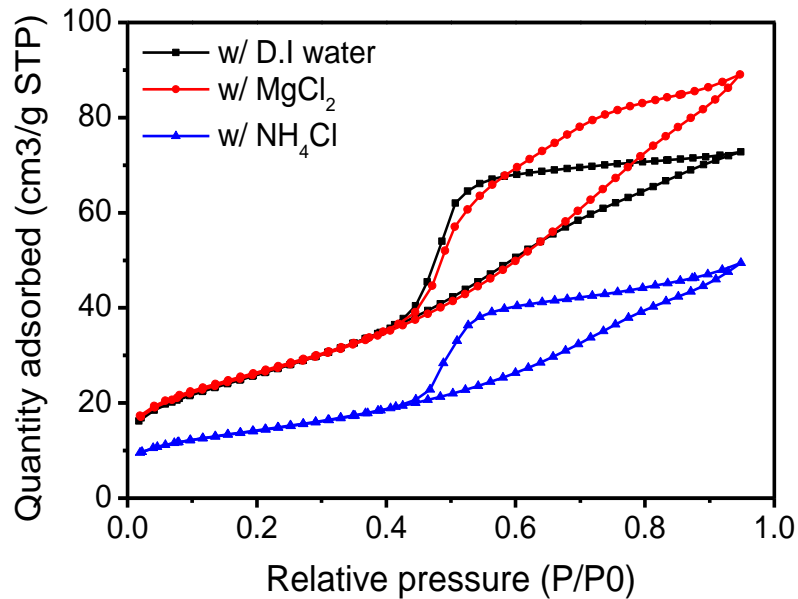


● Cl⁻

● Mg²⁺

Acidity: (100) > (110) = (111)

→ D.I. water, w/ NH₄Cl > w/ MgCl₂

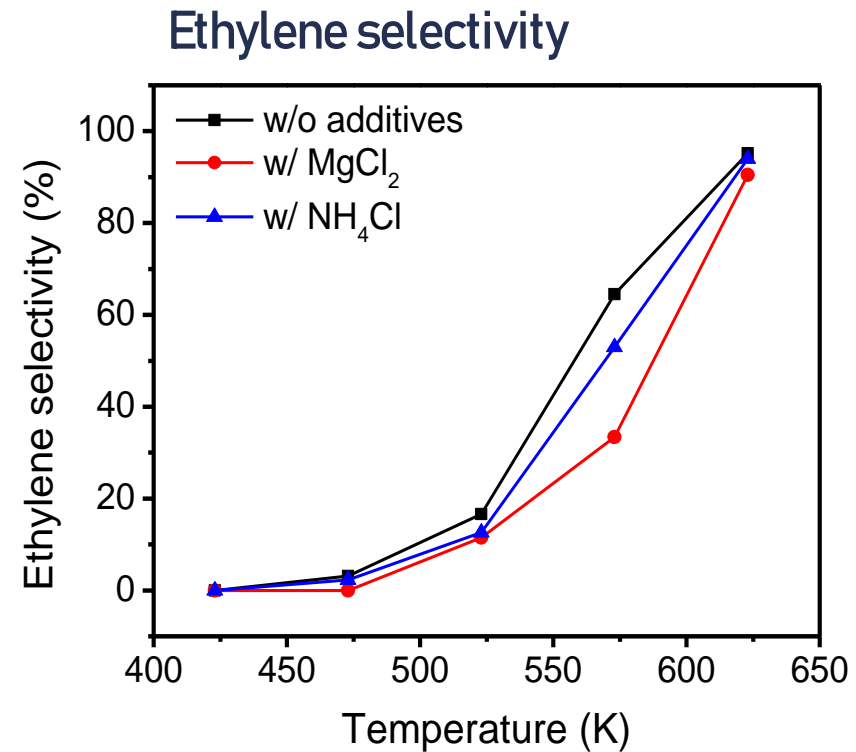
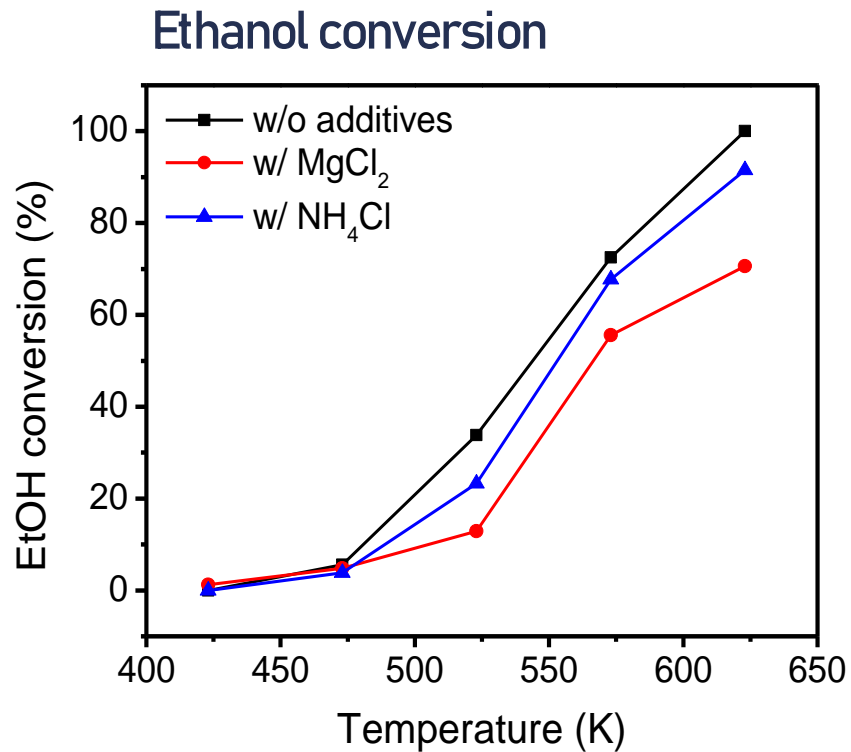


	BET surface area (m ² /g)	Average pore diameter (nm)	Total pore volume (cm ³ /g)
D.I. water	93	4.0	0.11
MgCl ₂ solution	100	4.7	0.13
NH ₄ Cl solution	72	4.6	0.07

High porosity

Results and discussion ③ Ethanol dehydration

- Ethanol dehydration: $\text{C}_2\text{H}_5\text{OH} \rightarrow \text{C}_2\text{H}_4 + \text{H}_2\text{O}$ $\Delta H_{298} = +44.9 \text{ kJ mol}^{-1}$
- Ethanol dehydrated on acid sites of alumina surface



Thank You for Listening