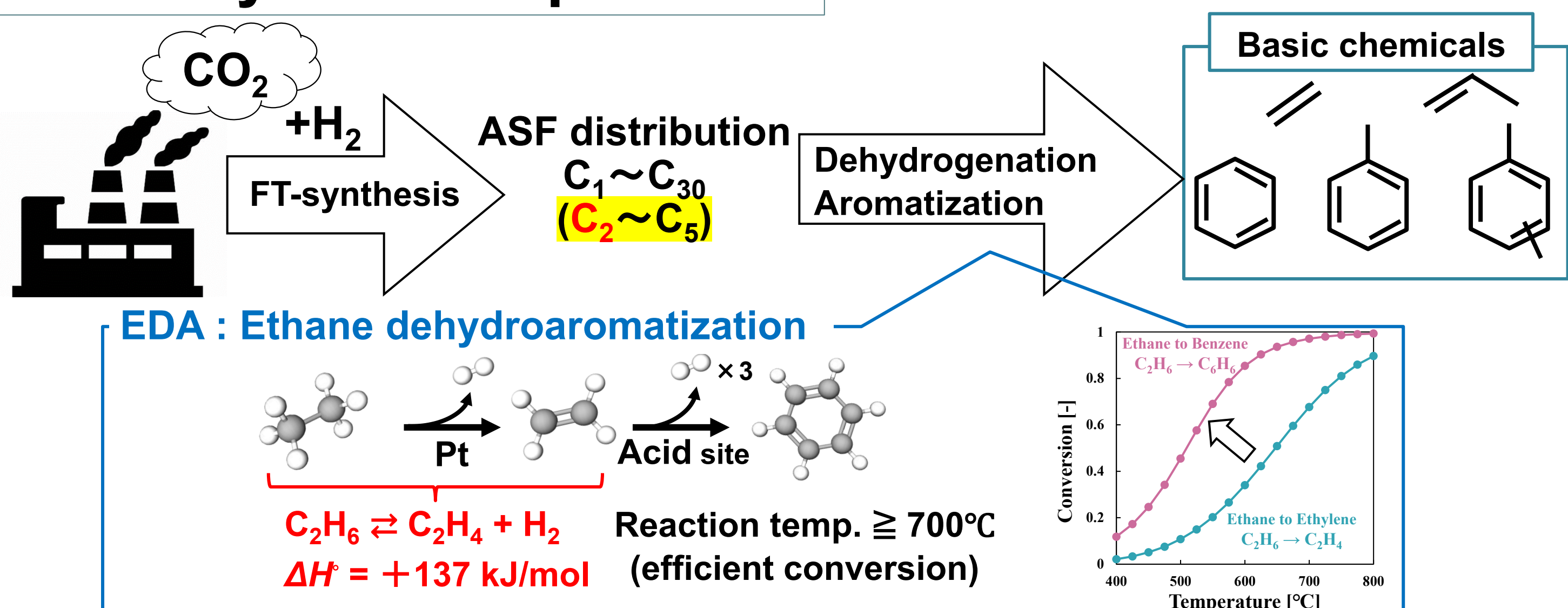
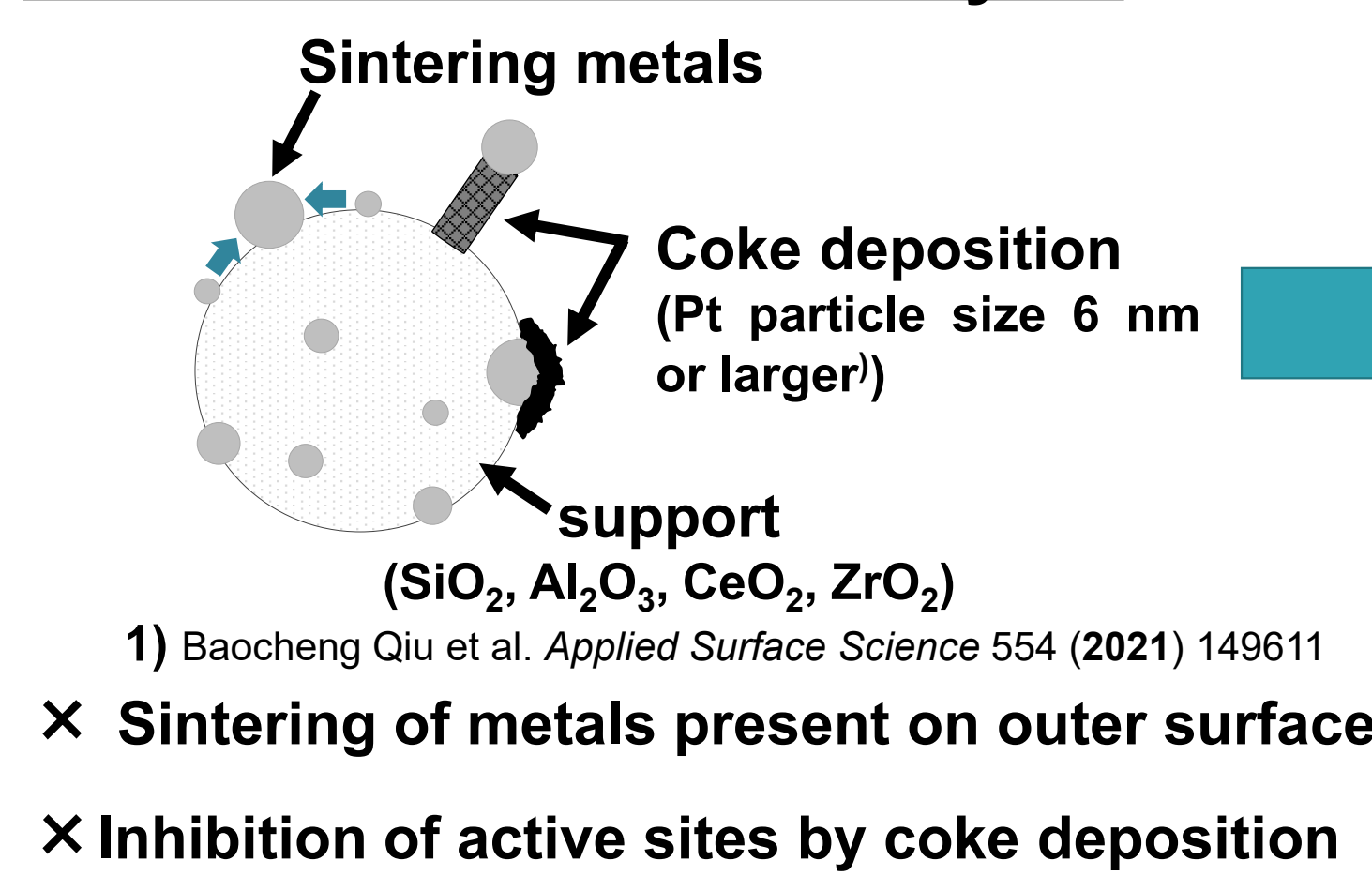


INTRODUCTION

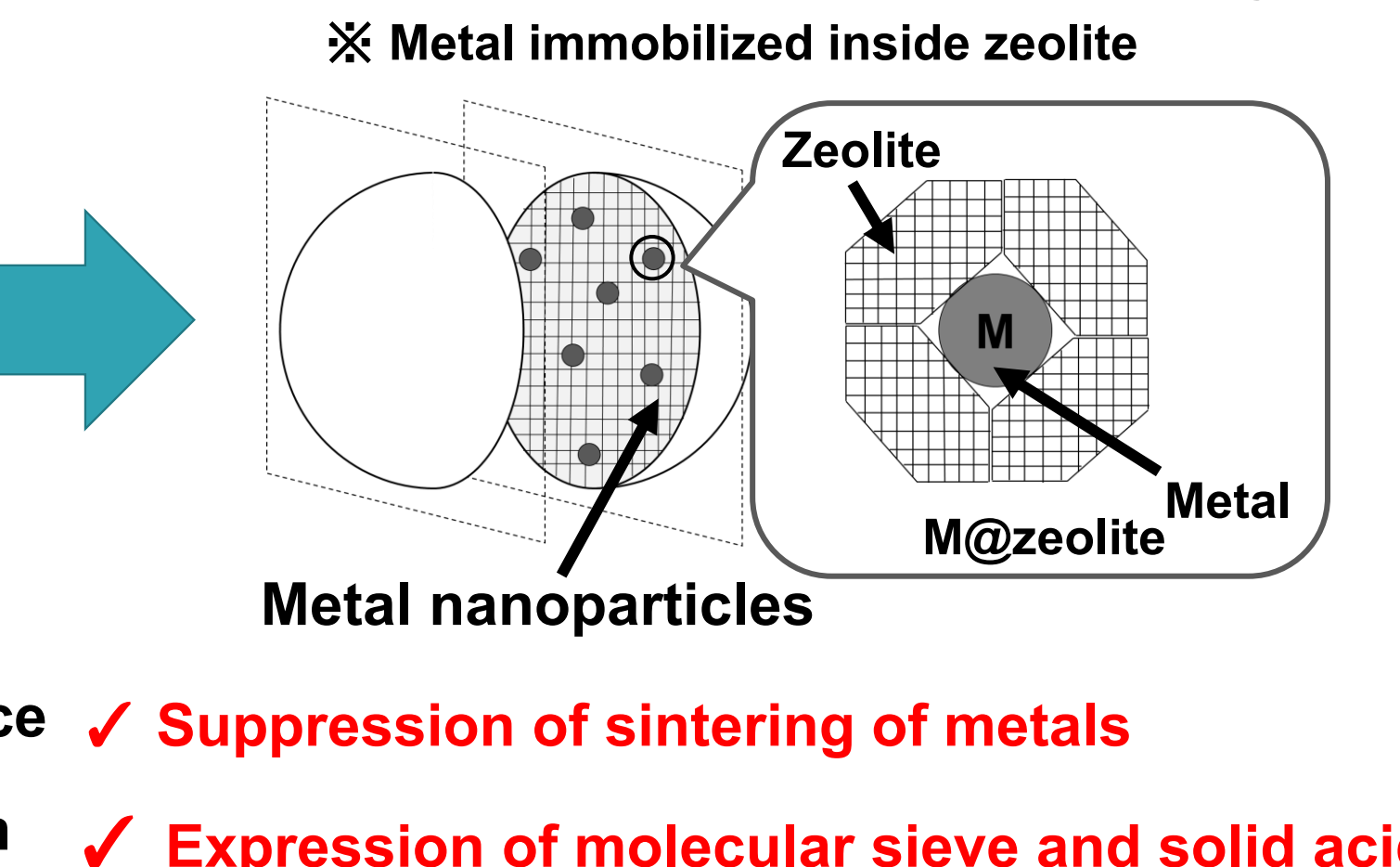
Catalyst development



Conventional metal catalysts



Zeolite-encapsulated metal catalysts



Objective

Development of Pt-supported Zeolite Catalysts with Excellent Sintering Resistance

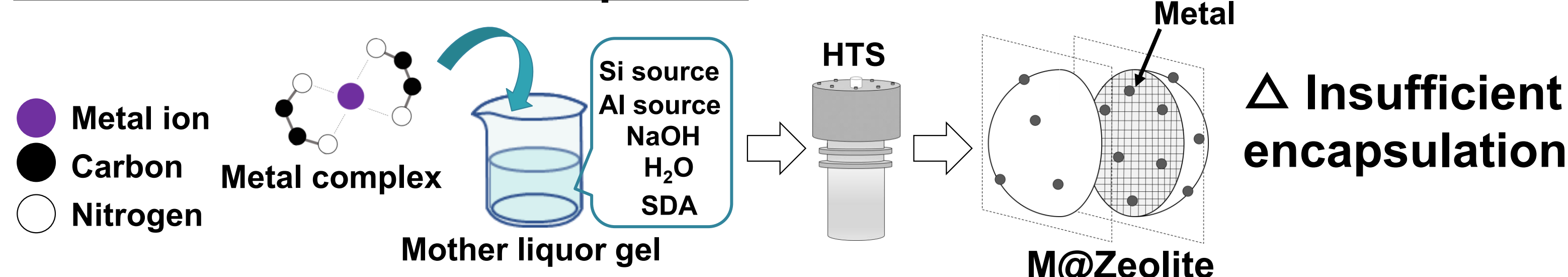
- Verification of encapsulation structure
- Evaluation of thermal stability of Pt (EDA@700)

Preparation of metal-encapsulated zeolite catalysts

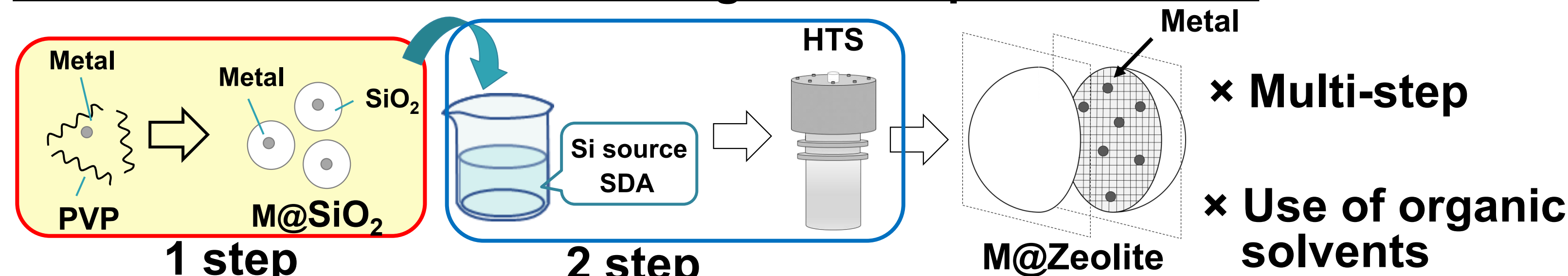
Need to stabilize metal precursors

Prevent precipitation of metal hydroxides in mother liquor gel

Case 1: Use of metal complexes

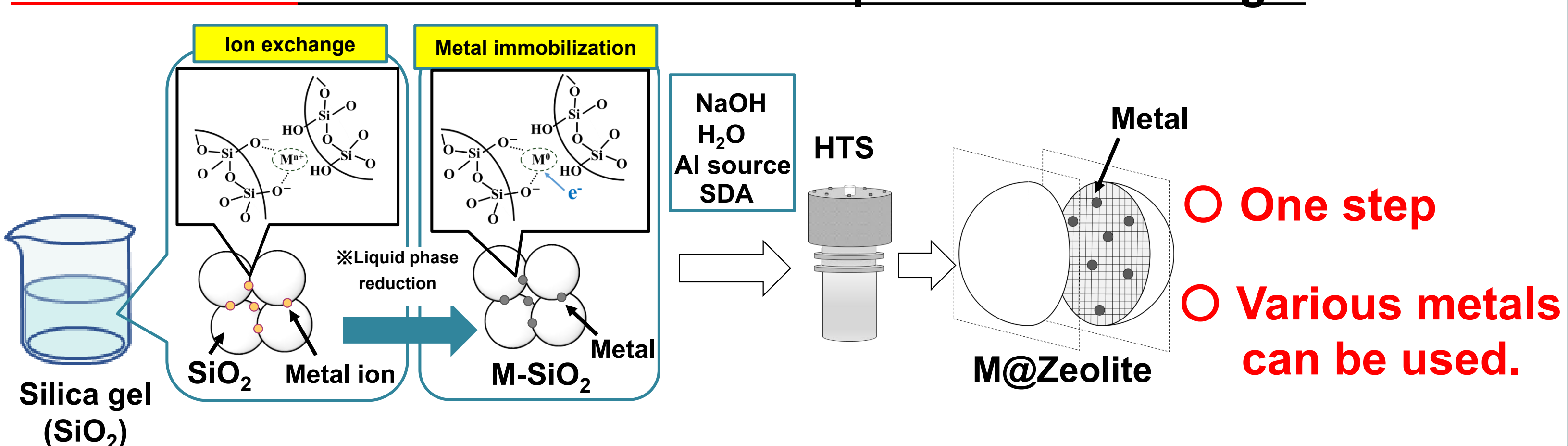


Case 2: Method for silica coating of metal precursors 1)2)



2) Hiroyasu Fujitsuka, Shuto Oshima, Yusei Matsumura, Teruoki Tago *Catalysis Today* 375 (2021) 360–368
3) Takahito Kobayashi, Takaaki Furuya, Hiroyasu Fujitsuka, Teruoki Tago *Chemical Engineering Journal* 377 (2019) 120203

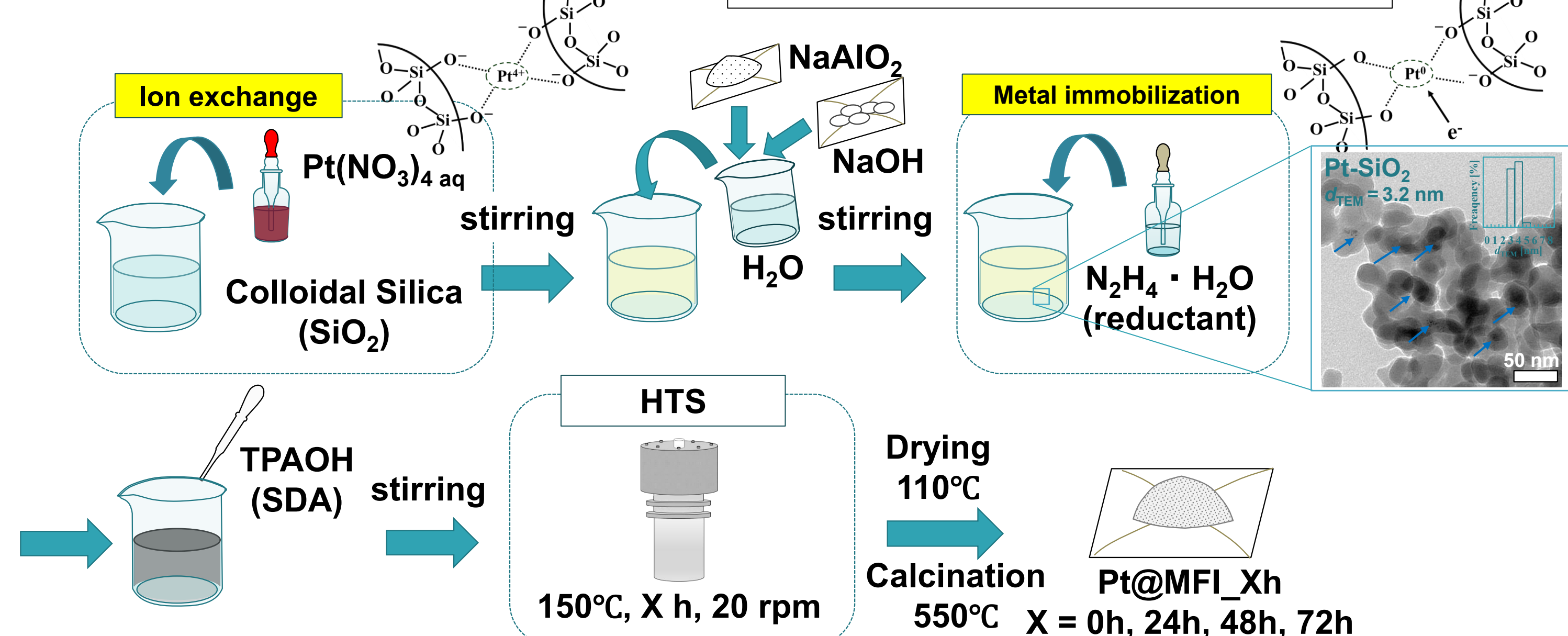
New method : Immobilization of metal particles to silica gel



Catalyst Preparation

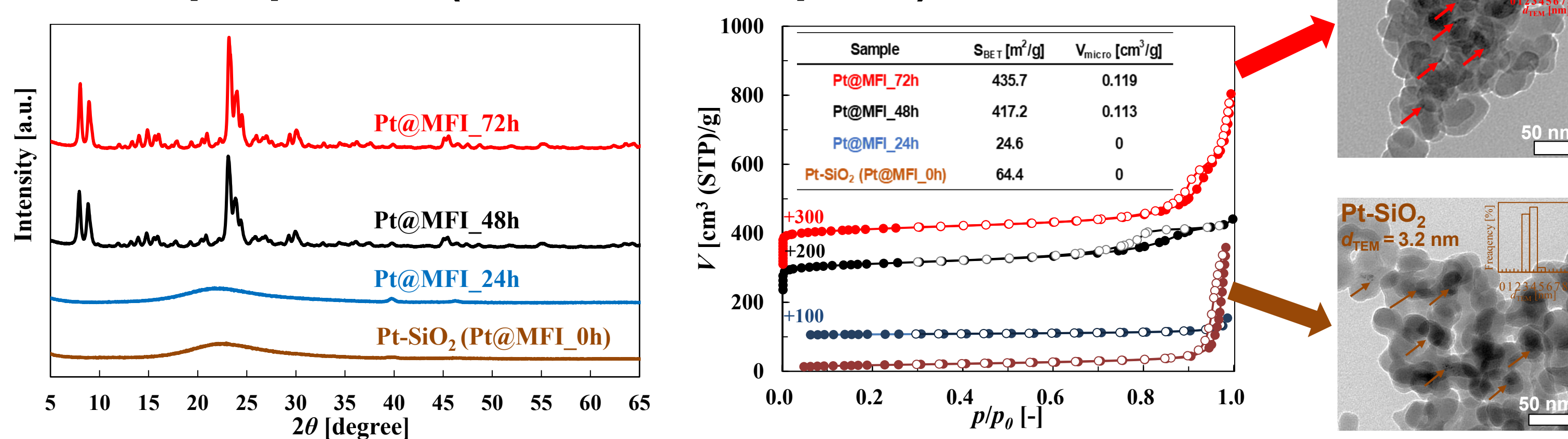
Preparation Procedure

SiO₂ : Al₂O₃ : Na₂O : TPAOH : H₂O
40 : 1 : 8.6 : 8.8 : 600



Characterization

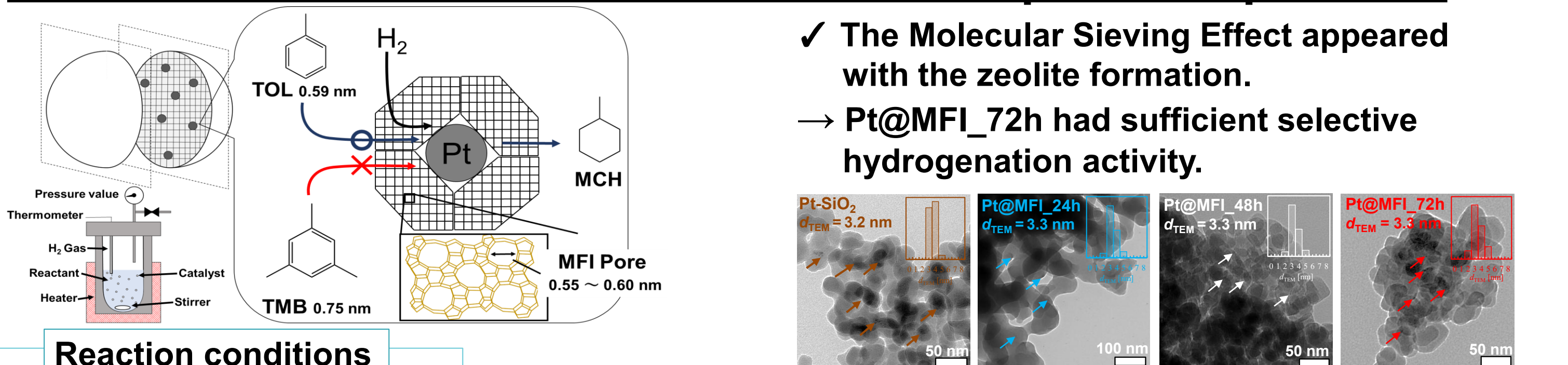
Zeolite properties (XRD, N₂ adsorption)



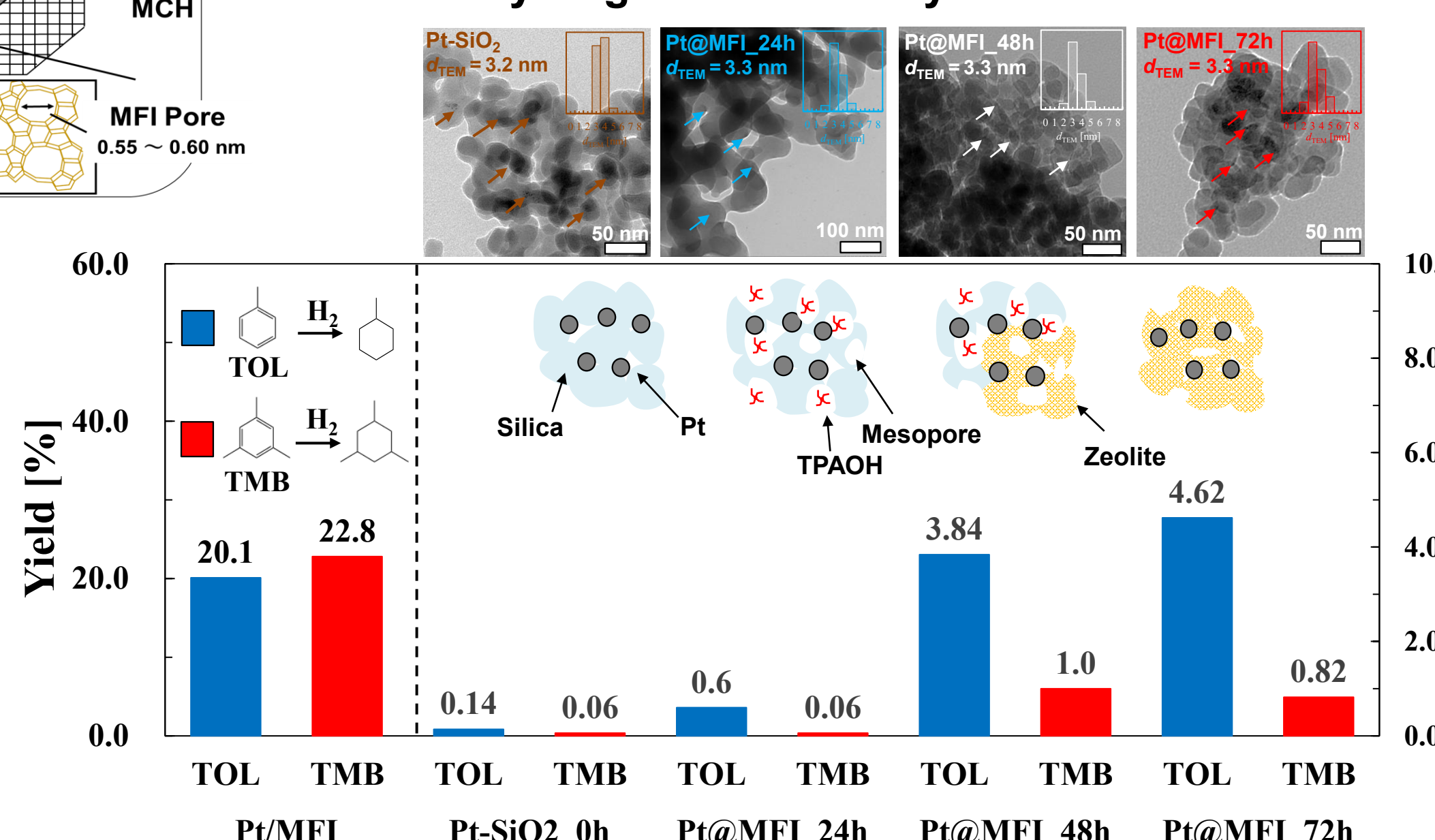
✓ MFI type peak (48 h~)

✓ Micropore development (48 h~)

Confirmation of immobilization location of platinum particles



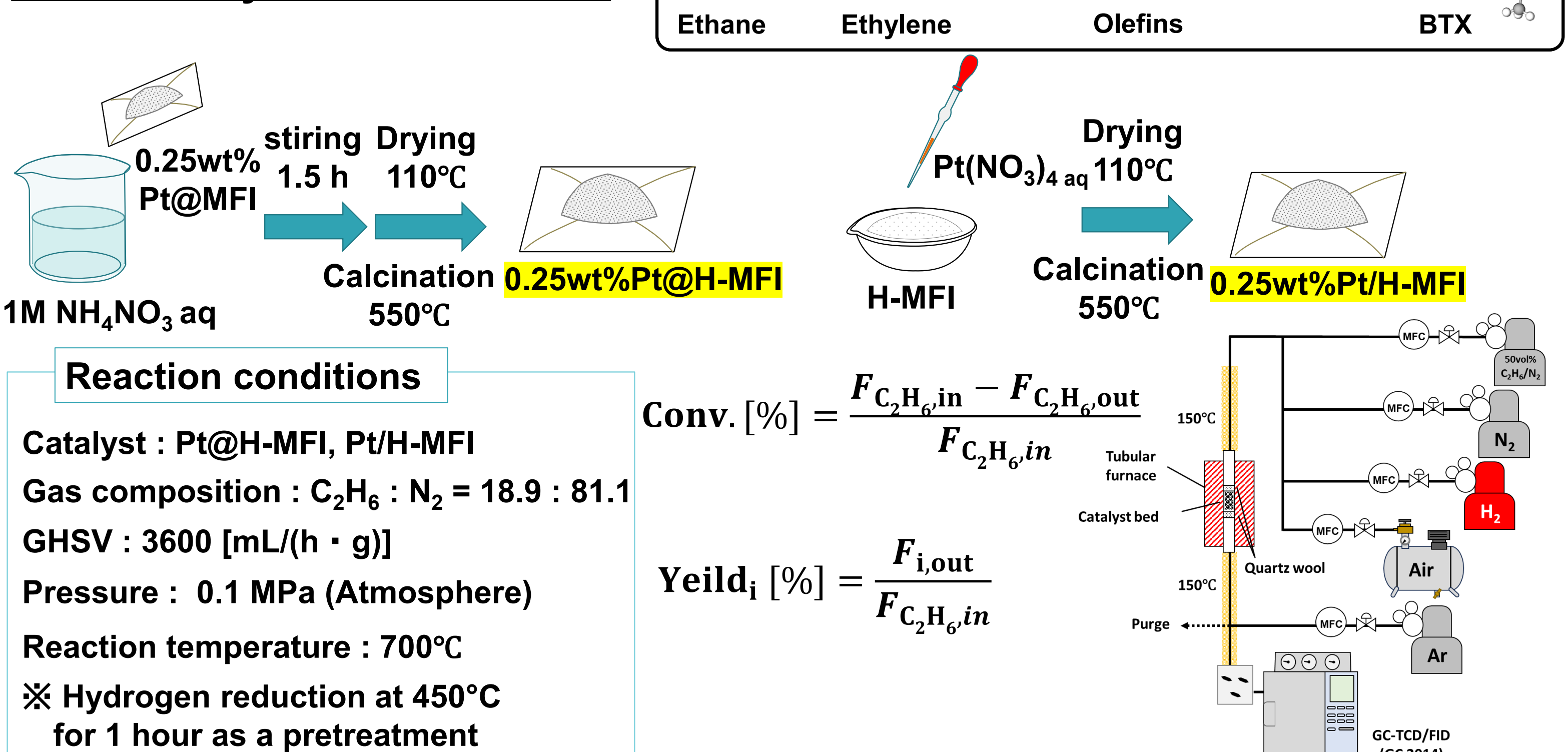
✓ The Molecular Sieving Effect appeared with the zeolite formation.
→ Pt@MFI_72h had sufficient selective hydrogenation activity.



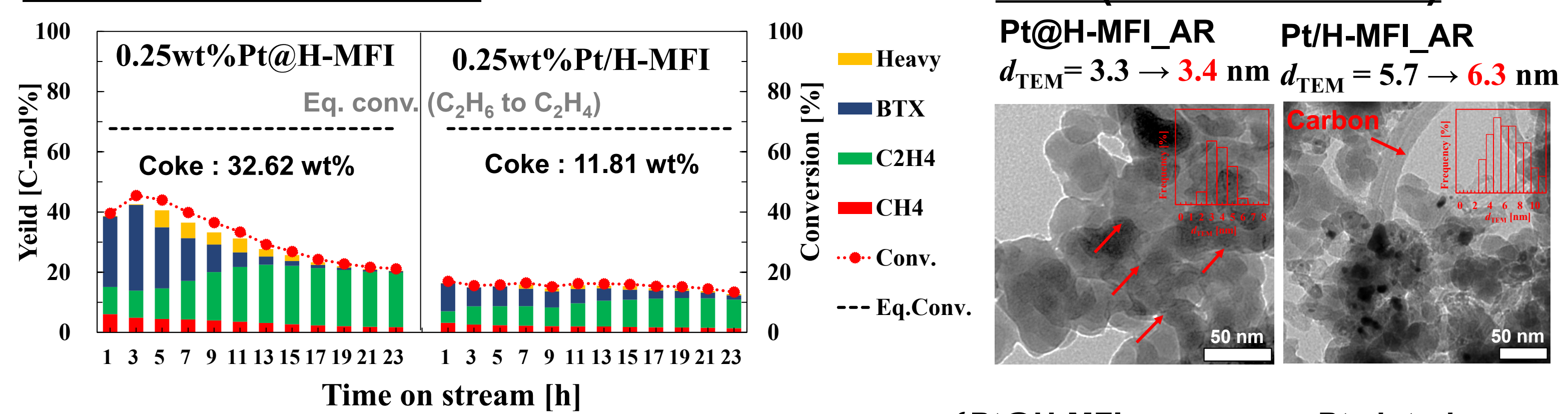
Evaluation of thermal stability

Reaction test

Ethane dehydroaromatization



Product distribution



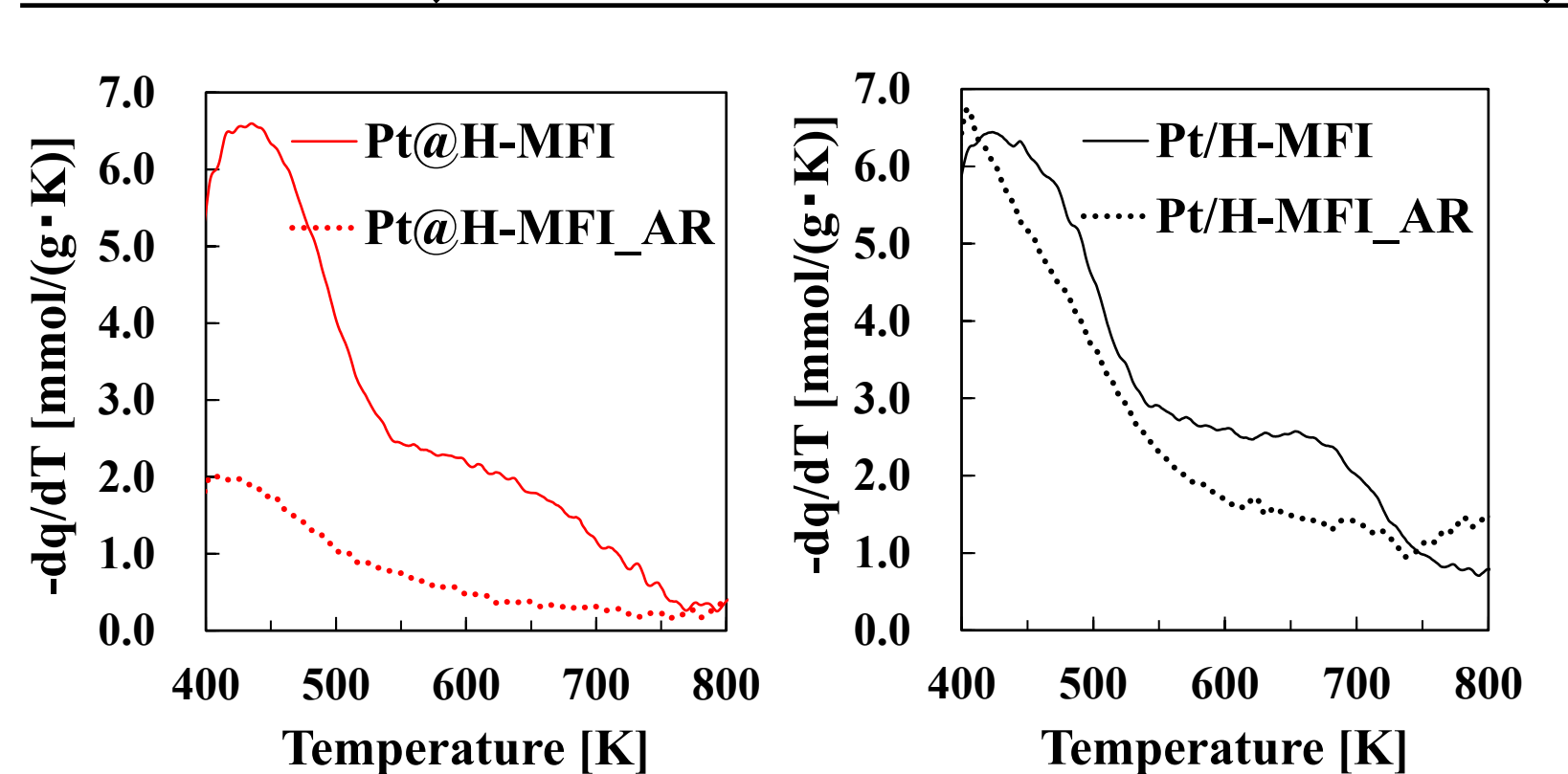
✓ Pt@H-MFI shows high activity

→ High dehydrogenation capacity by Pt fine particles

✓ Pt@H-MFI suppresses Pt sintering

✓ Pt/H-MFI was confirmed fiber carbon formation

NH₃-TPD (Before and after reaction)



✓ Decrease in NH₃ desorption peak (550~750K)
→ Coverage of acid sites by coke deposition

✓ Decrease in micropores
→ Pore blocking due to coke deposition

Conclusion

- ✓ MFI zeolite-encapsulated metal catalysts were successfully prepared using metal-supported silica gel as a precursor.
- ✓ The thermal stability of metals was confirmed by using metal catalysts encapsulated in MFI zeolite.

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