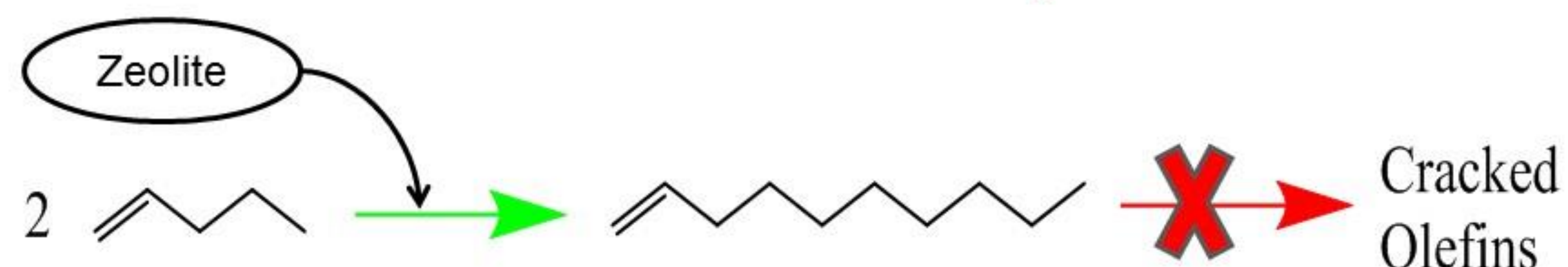
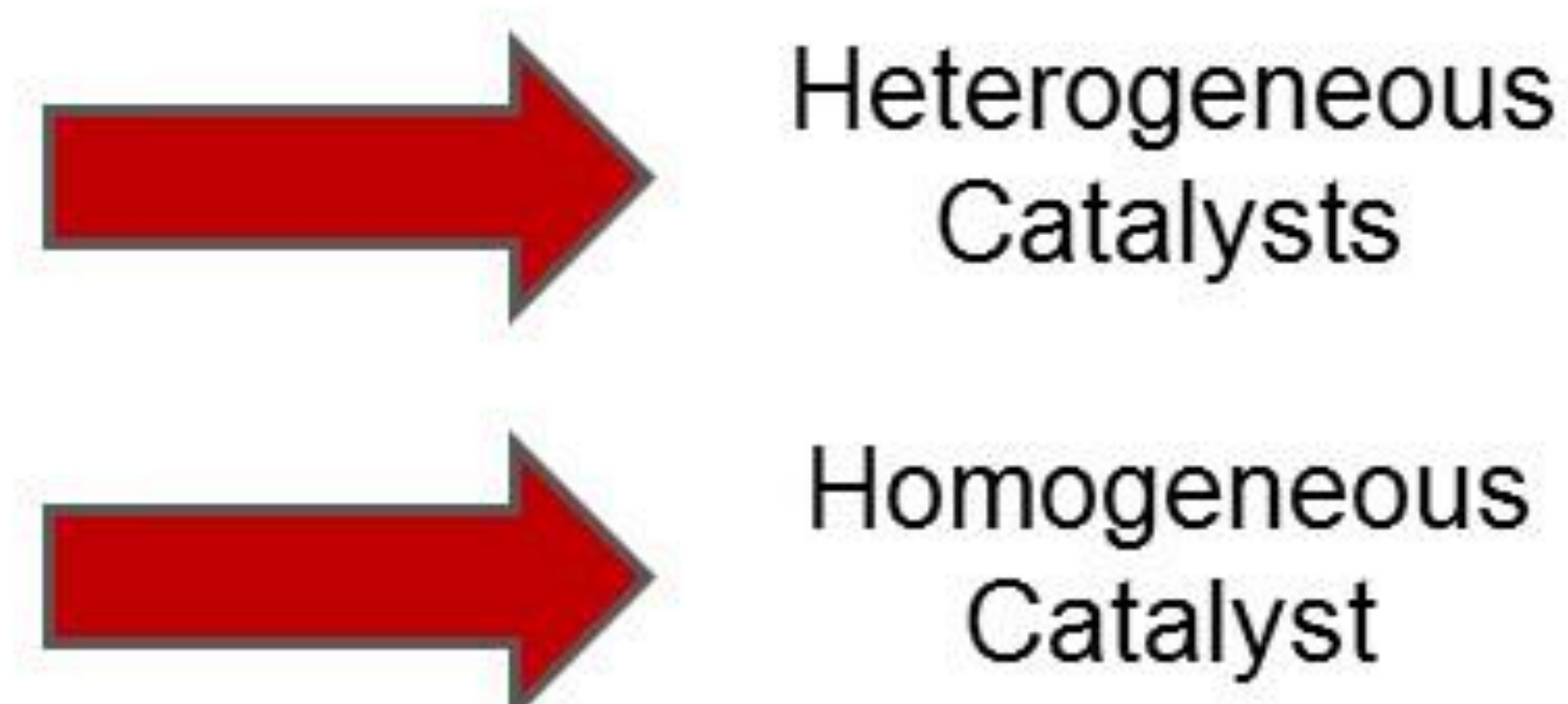


Motivation

- Oligomerization of light olefins ($C_2 - C_4$)

- Zeolites [1 - 4]
- Mesoporous aluminosilicates [5]
- Solid phosphoric acid [6]
- N-heterocyclic carbenes [7]

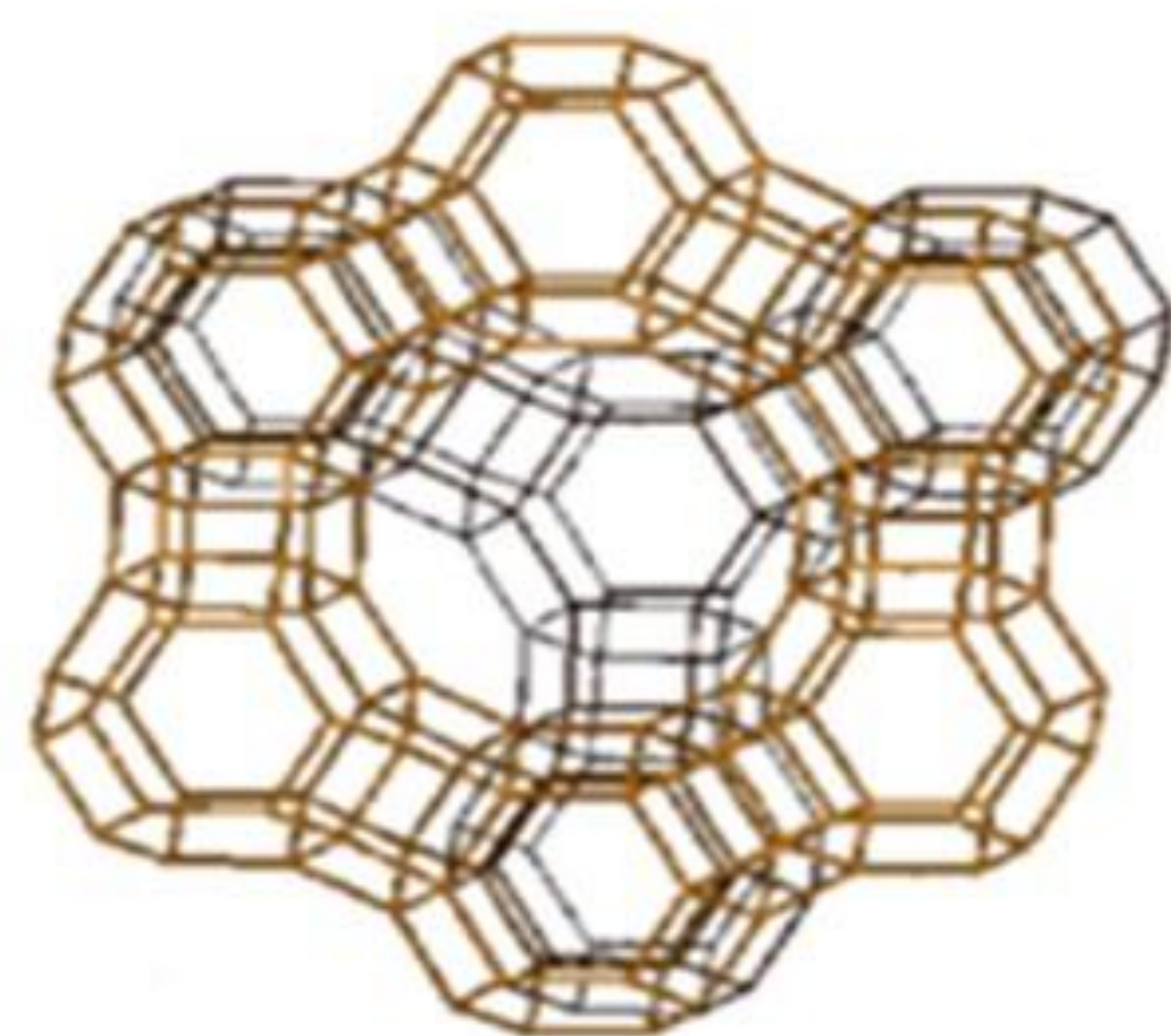


- Separate phase heterogeneous catalysts
- Zeolites – High activity & suitable selectivity → branched C_{10} alkanes – high octane number
- Regenerated by burning off coke

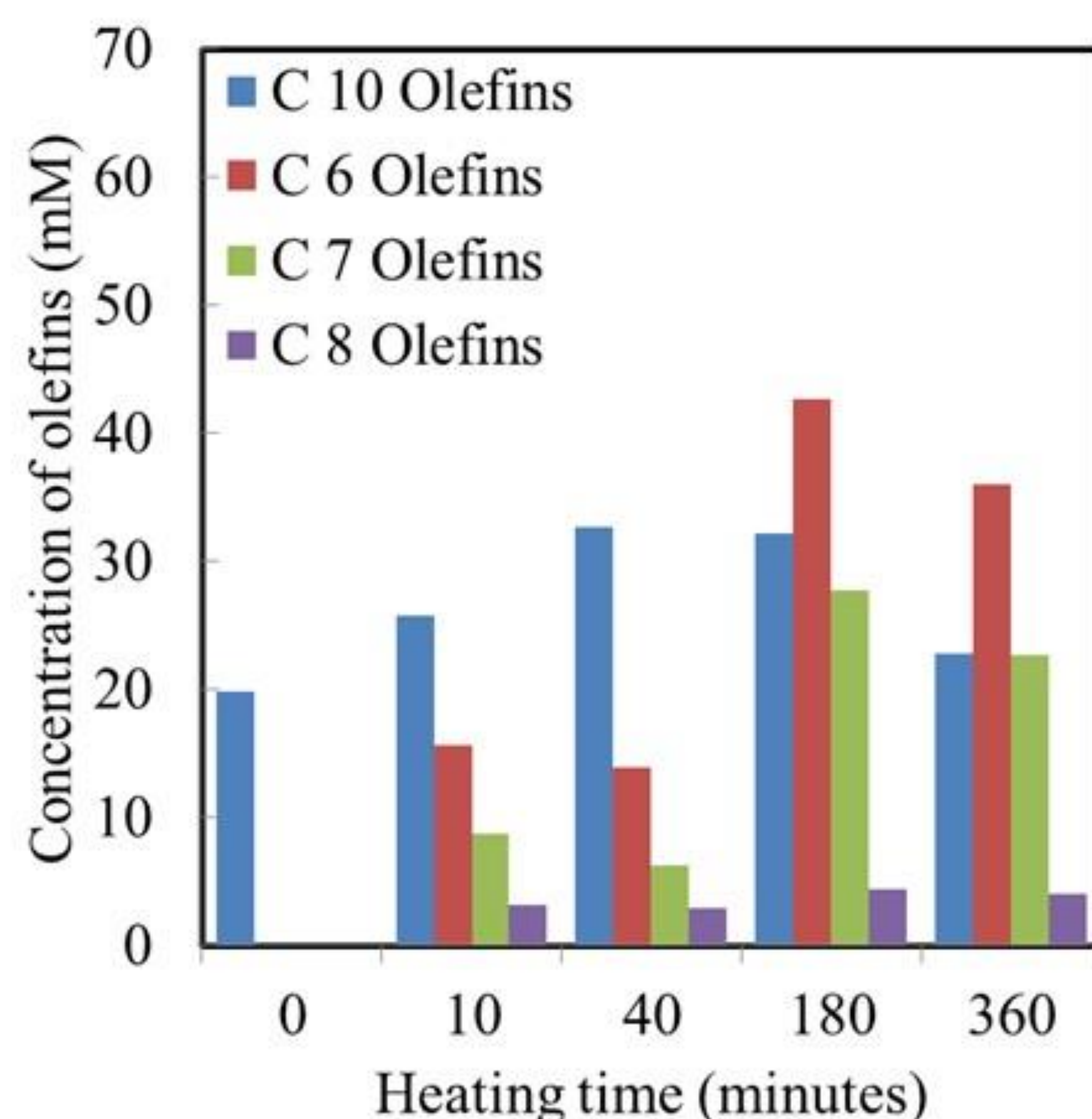
[1] Corma, *J. Catal.*, 300 (2013) 183-196
 [2] Schmidt, *Energy and Fuels*, 22 (2008) 1148-1155
 [3] Coelho, *Fuel*, 111 (2013) 449-460
 [4] Mertens, *Angew. Chem. Int. Ed.*, 39 (2000) 4376-4379

[5] Catani, *Catalysis Today*, 75 (2000) 125-131
 [6] Bekker, *Ind. Eng. Chem. Res.*, 48 (2009) 10156-10162
 [7] McGuinness, *Dalton Trans.*, (2009) 6915-6923

FAU (Si/Al 15)



- Super cage of FAU
- $C_6 - C_8$ olefins formed by cracking of C_{10} olefins
- High catalytic activity over FAU, even at 0 minutes
- Increased $C_6 - C_8$ olefins at long duration



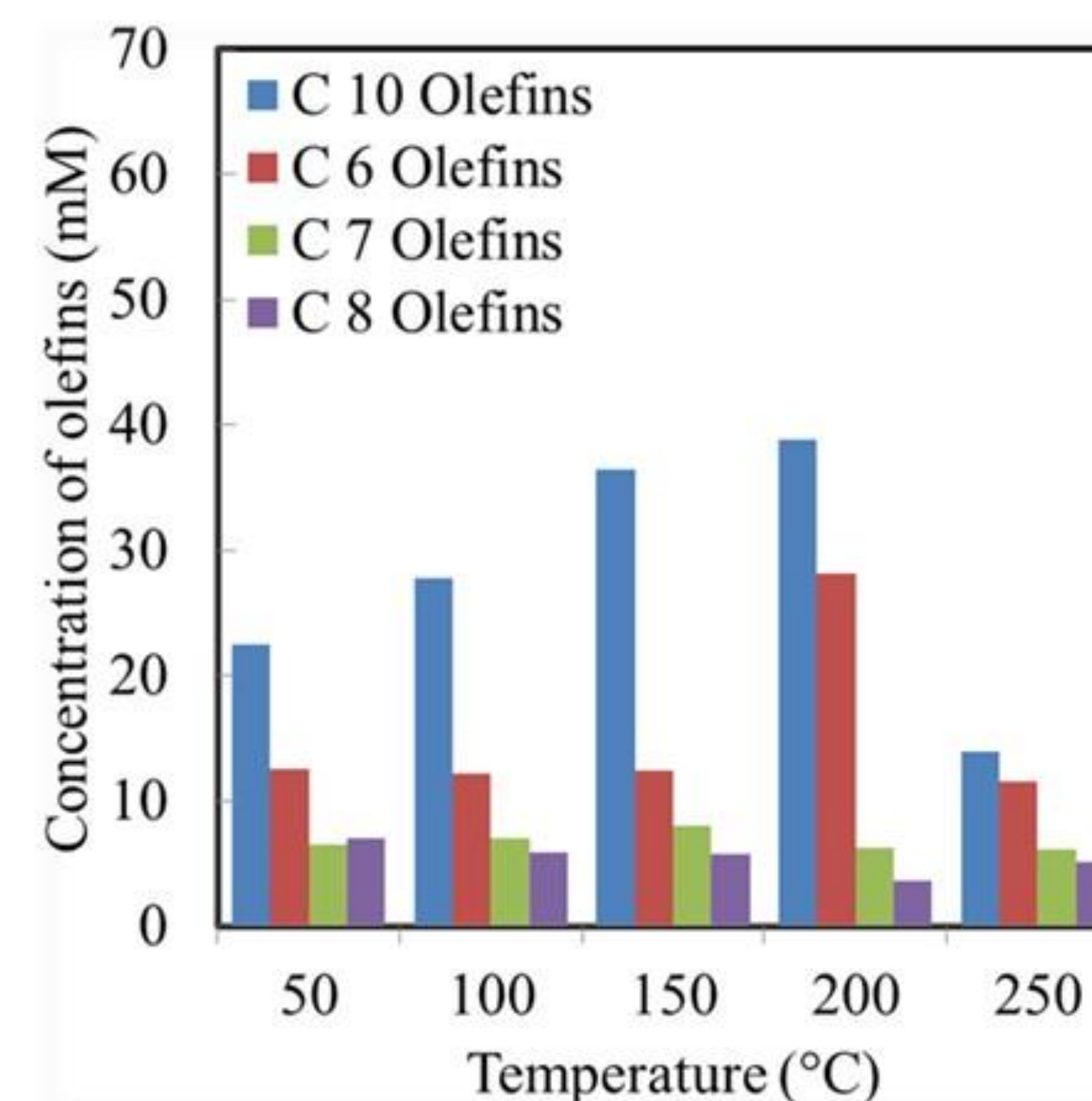
Initial concentration of pentene: 300mM

Temperature: 200°C

Mass of zeolite: 11.4 mg

Effect of Temperature

- High catalytic activity over FAU 6
- Increase in oligomerization and cracking with increase in temperature
- High cracking activity over 200°C
- Reduction in selectivity with increase in temperature



Temperature (°C)	Yield of C_{10} oligomers (%)	Atom Selectivity toward C_{10} oligomers (%)
50	14.2	55.9
100	17.6	62.2
150	23.2	67.4
200	24.6	61.7
250	8.8	47.7

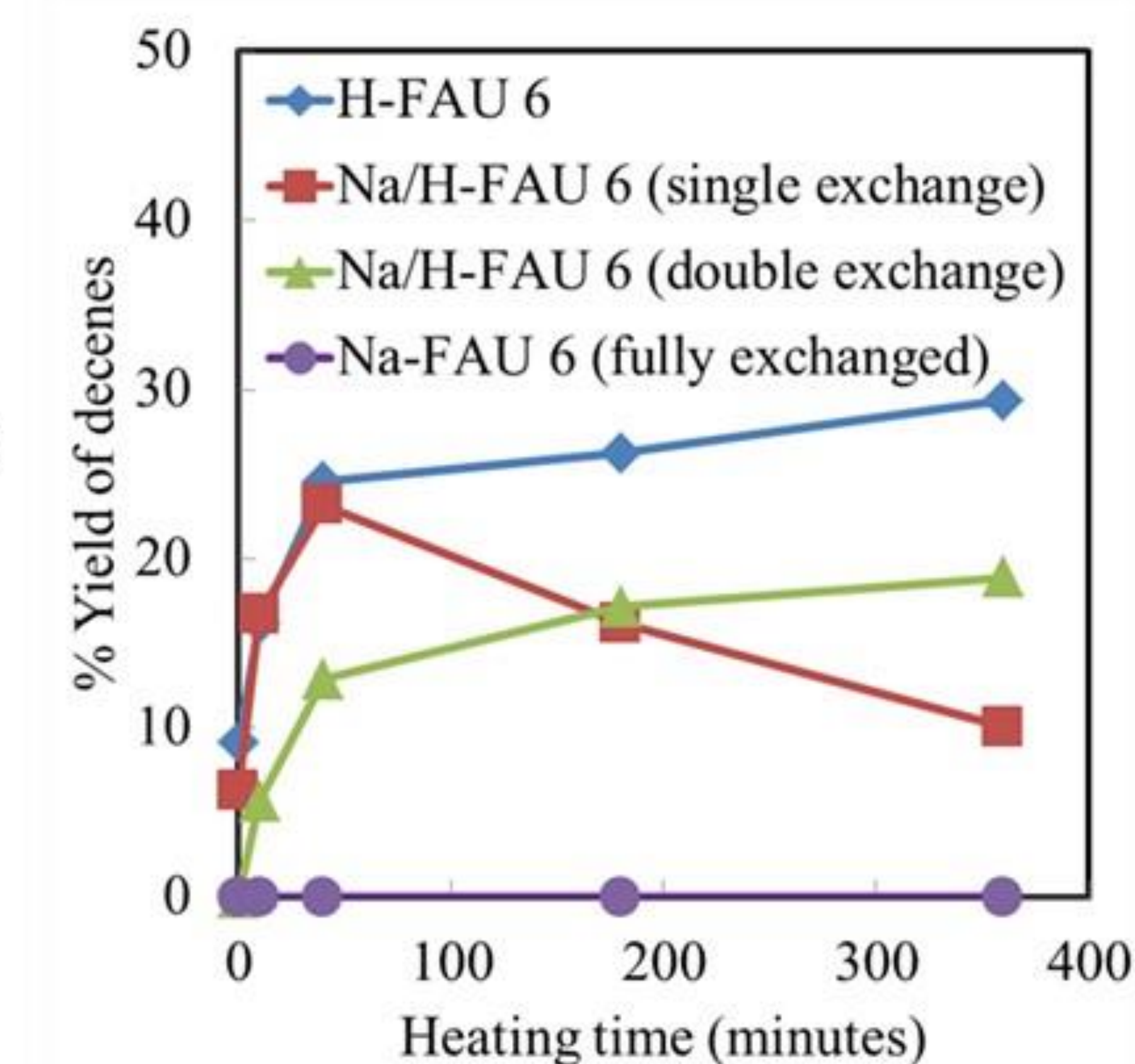
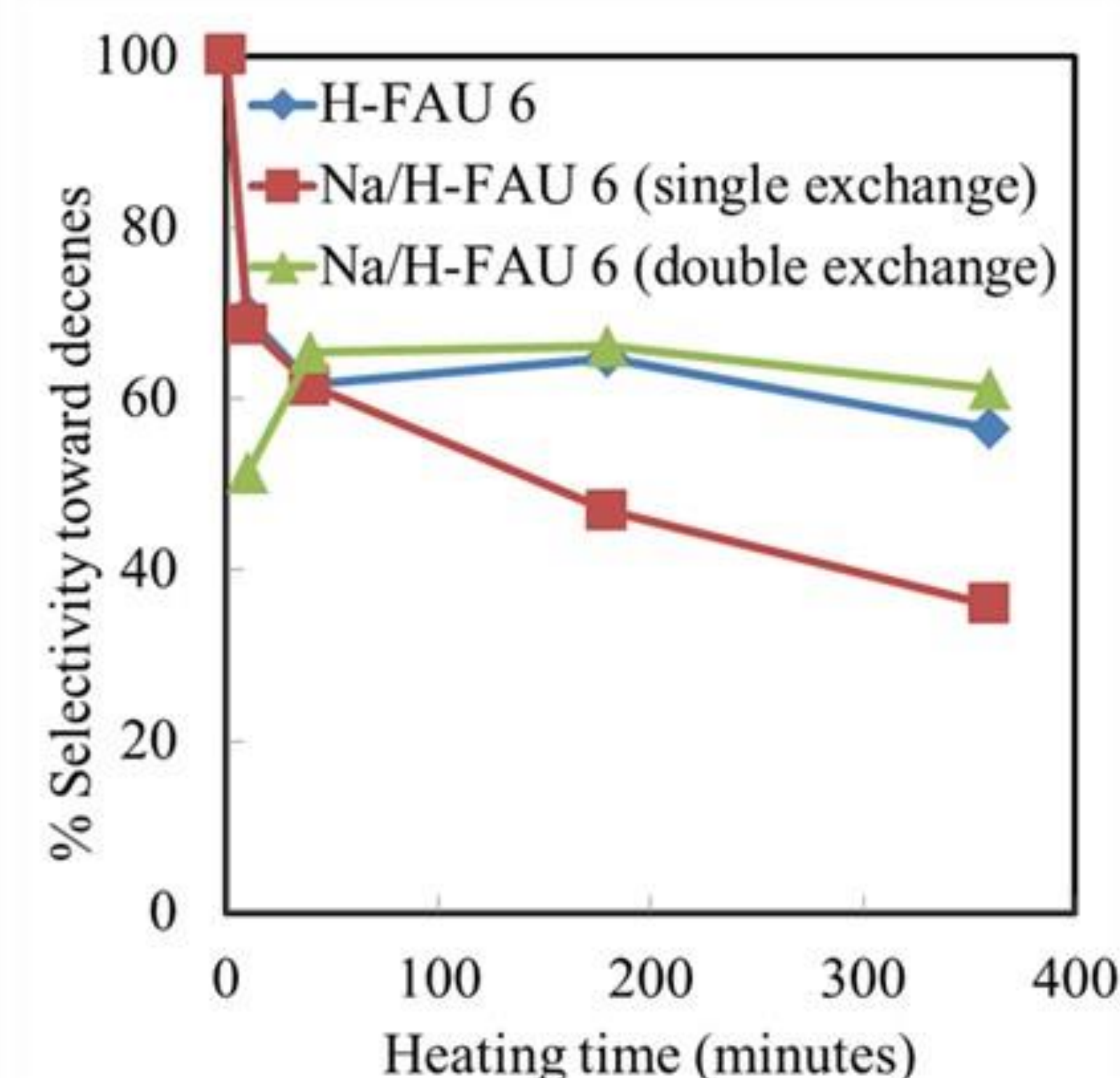
Initial concentration of pentene: 300mM

Time: 40 minutes

Mass of zeolite: 5 mg

Effect of Exchange of Active Acid Sites by Na^+ Ions

- Increase distance between acid sites → acid strength constant
- Reduce cracking of the long chain olefins
- Mass of zeolite for reaction maintained constant



- Acid sites per reaction reduced
- High coke deposition
- Complete substitution → inactive FAU

Initial concentration of pentene: 300mM

Temperature: 200°C

Mass of zeolite: 5 mg