



CHARLES UNIVERSITY
CENTRE OF ADVANCED MATERIALS

*Synthesis and Application
of Novel Porous Materials*

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EUROPEAN UNION
European Structural and Investing Funds
Operational Programme Research,
Development and Education



MINISTRY OF EDUCATION,
YOUTH AND SPORTS



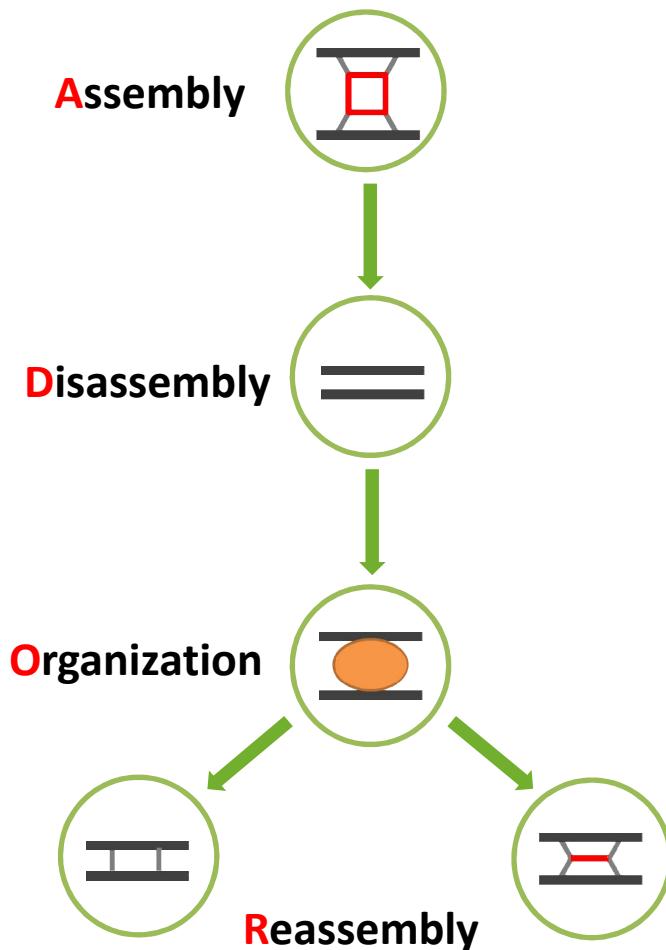
 hemistry of adorable zeolites

 pplication of isoreticular zeolites

 aterials with XL-pores: stabilization

Modular routes to novel materials: ADOR

Suitable candidates for top-down synthesis of 2D zeolites:



UTL
UOV
SAZ-1

IWR
ITH
ITR

CIT-13
ITG
SVV

IWW
IWV
UOS

IPC-4

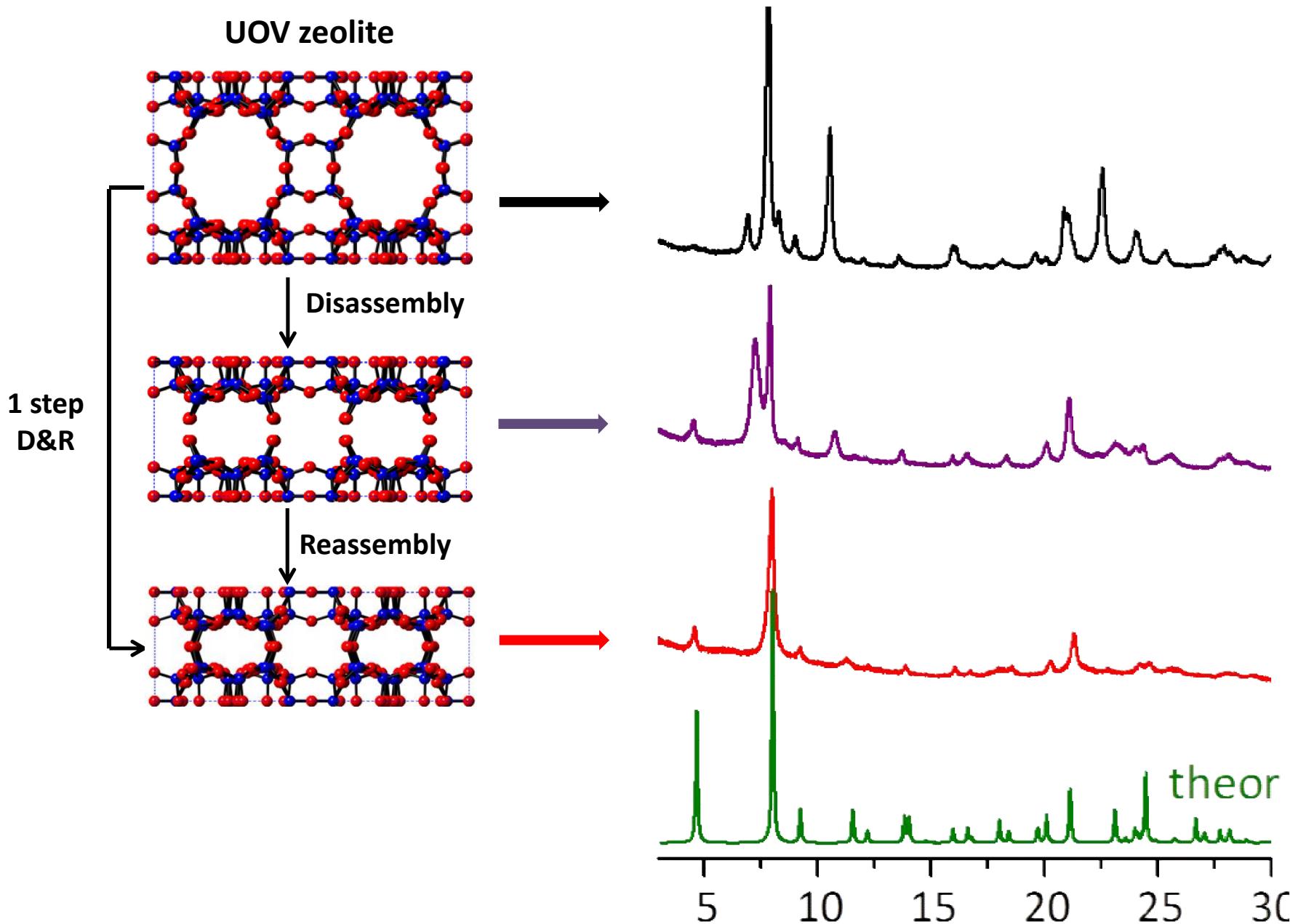
IPC-6,7

OKO (KUL)

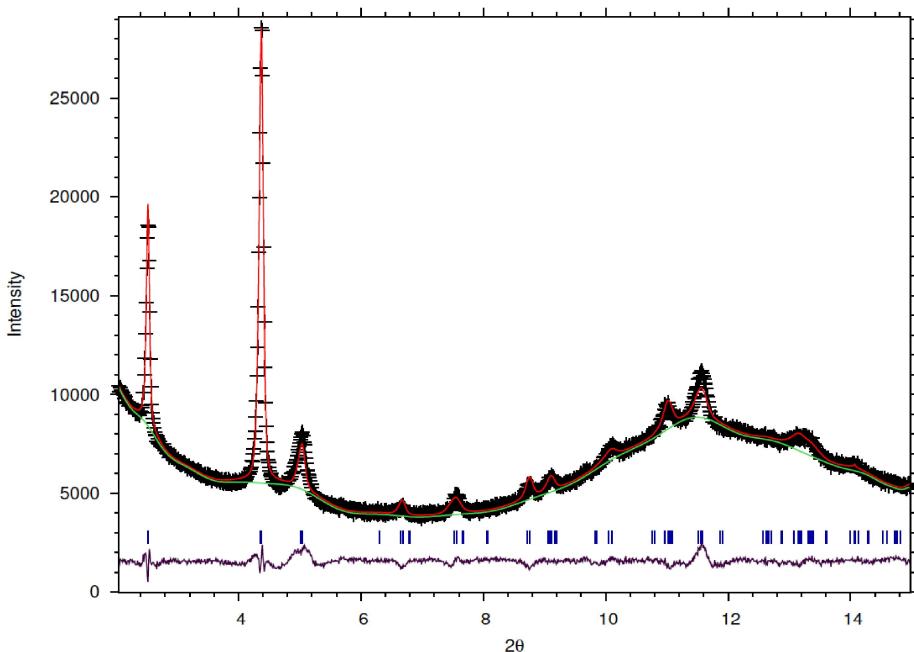
IPC-9,10



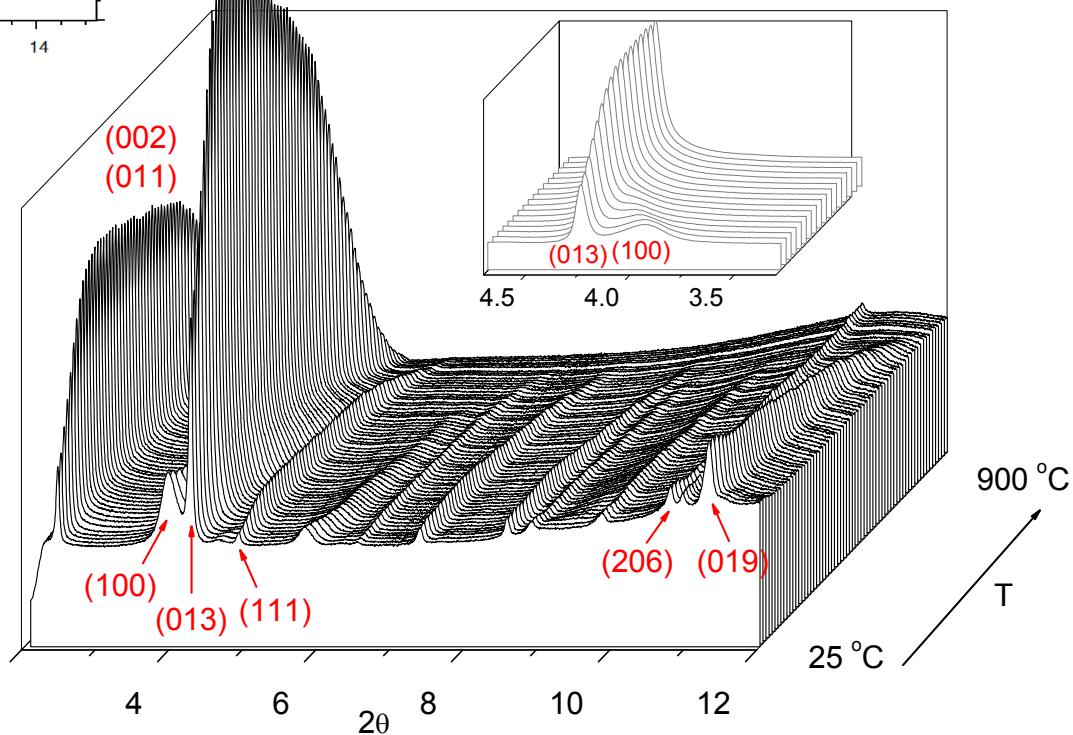
UOV-to-IPC-12



UOV-to-IPC-12

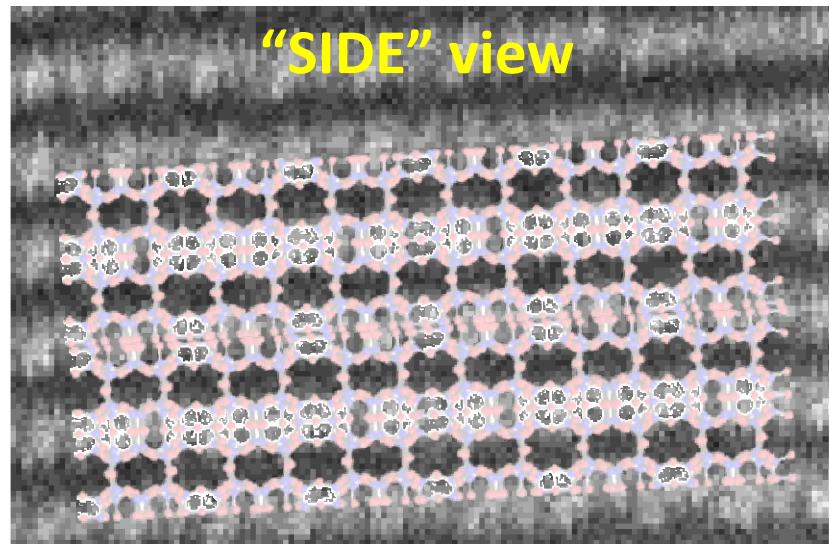
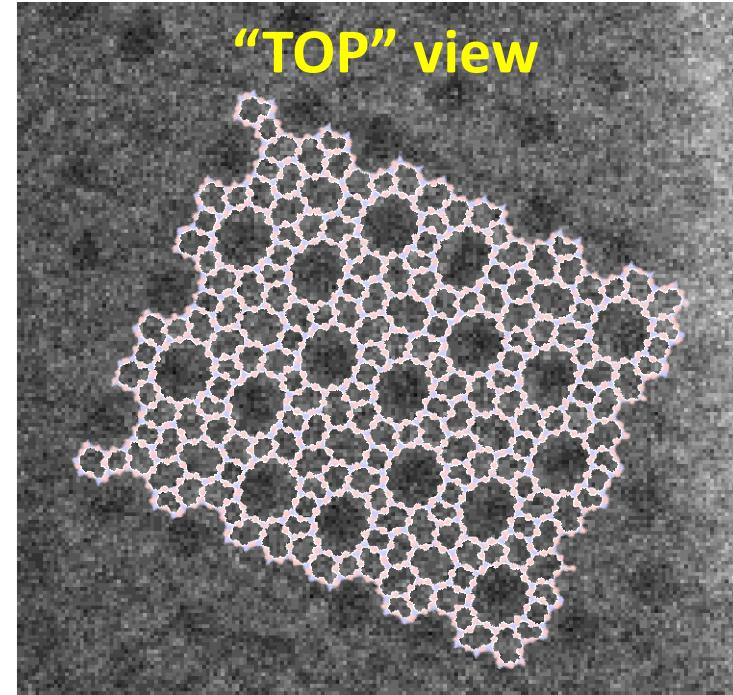
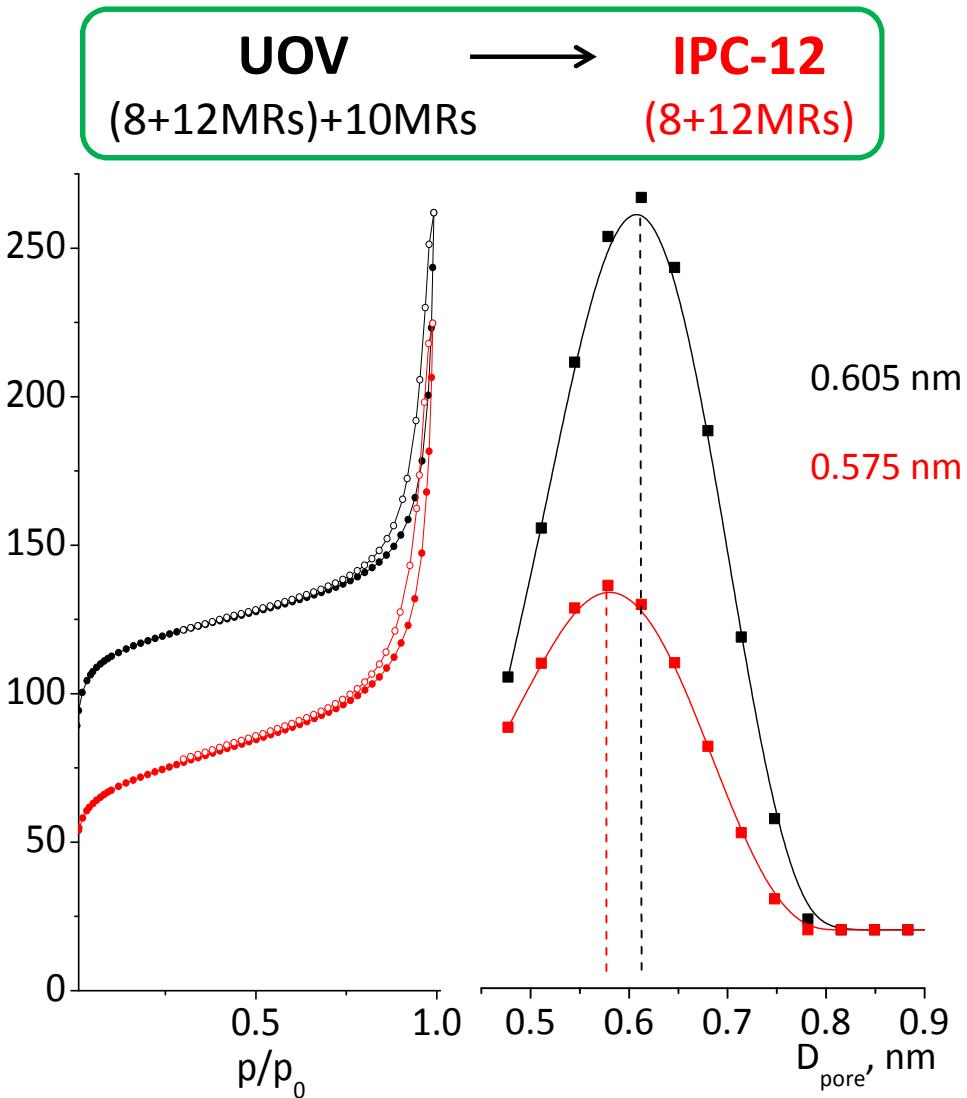


Observed (synchrotron XRD data) and calculated XRD pattern from the final Rietveld refinement together with the difference between the two

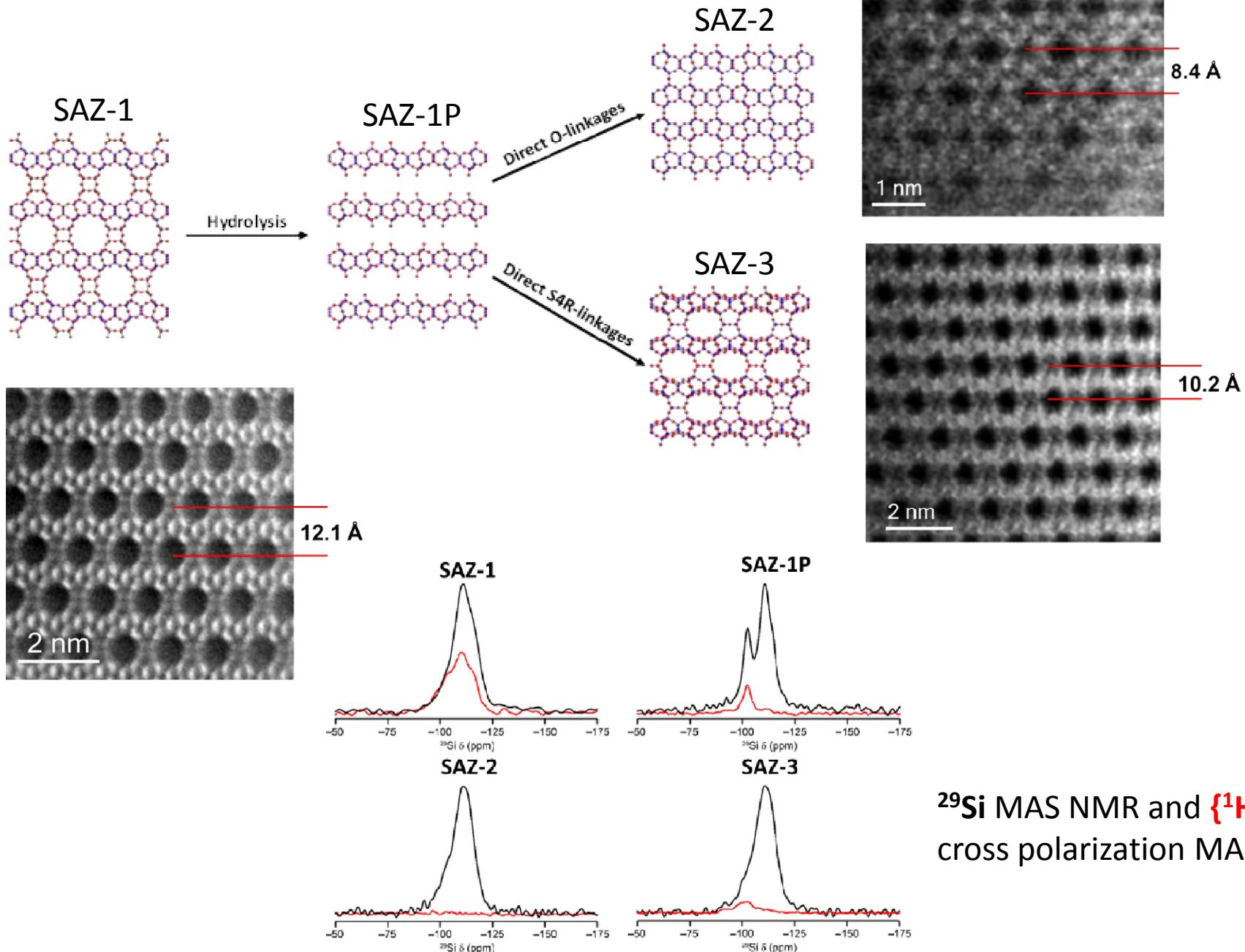


in situ XRD study upon continuous heating of IPC-12 precursor.
Insert: merging of (100) and (013) reflections at the beginning steps (reverse x-axis)

UOV-to-IPC-12

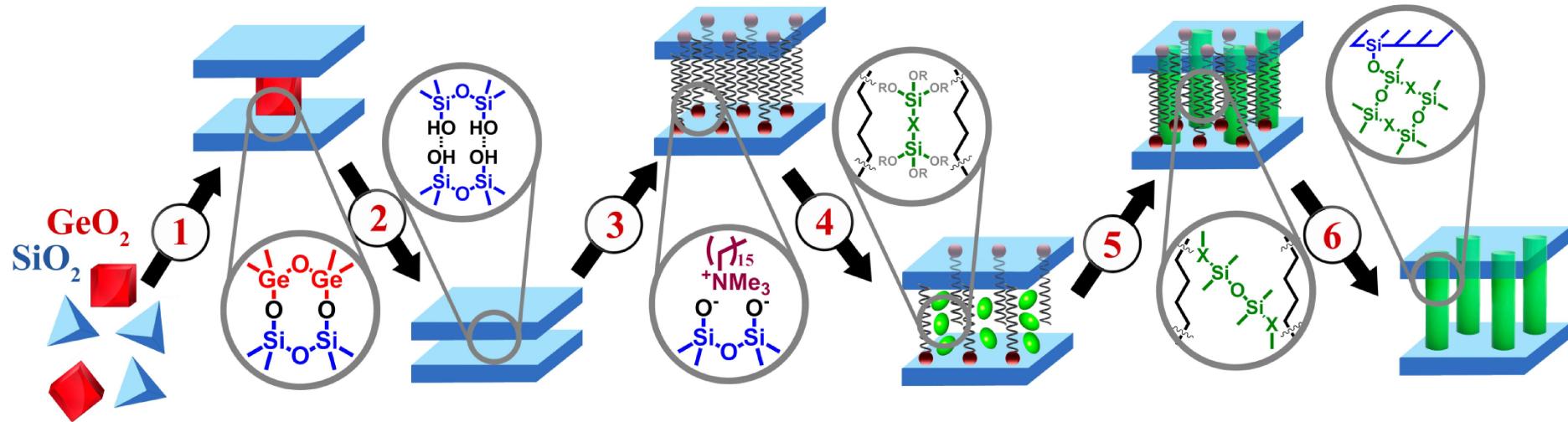


SAZ: from design to ADOR

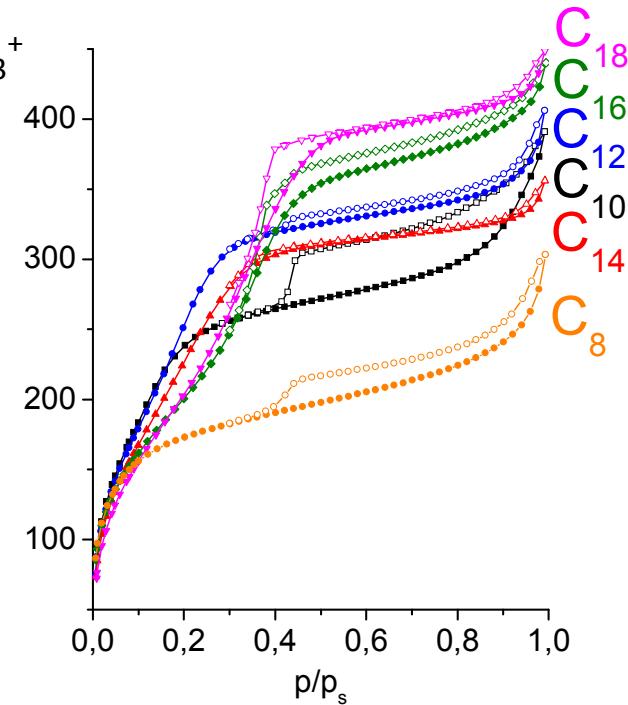
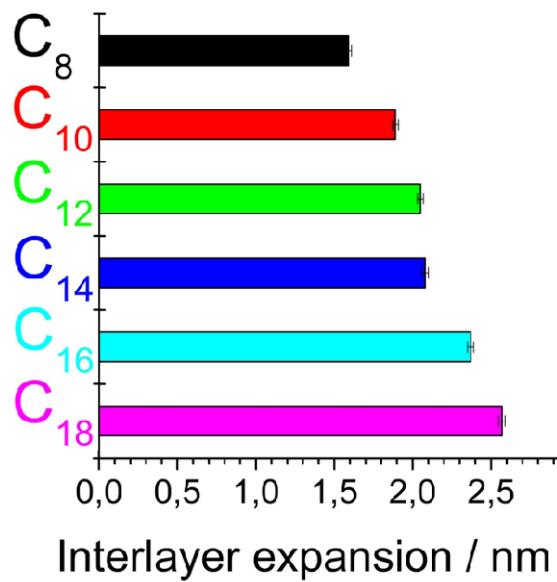


^{29}Si MAS NMR and $\{^1\text{H}\} \text{ } ^{29}\text{Si}$ cross polarization MAS NMR

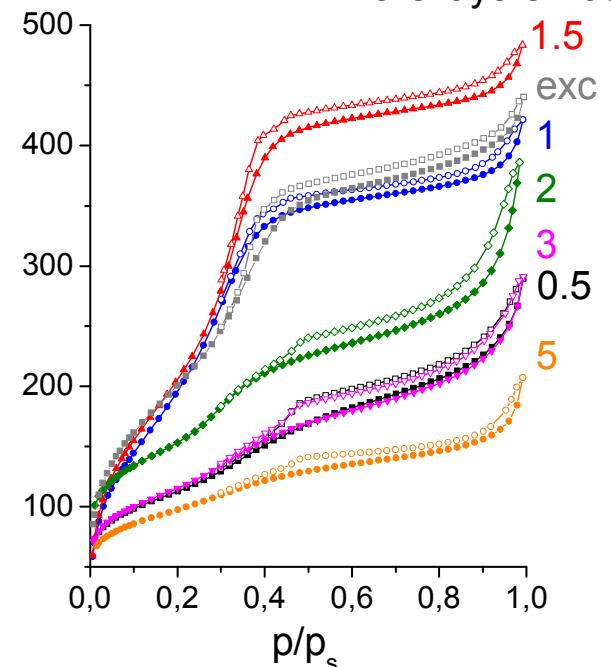
Interlayer space: adjusting and design of hybrids



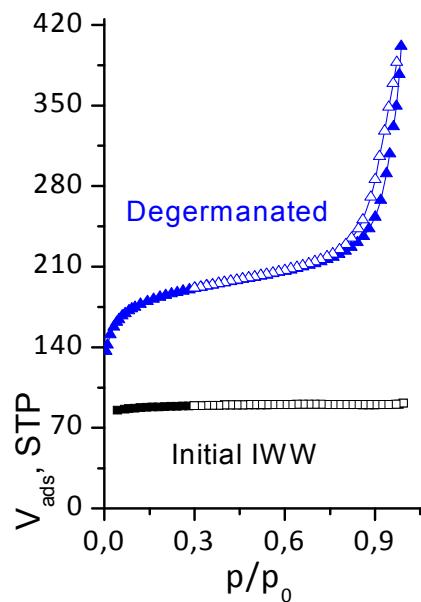
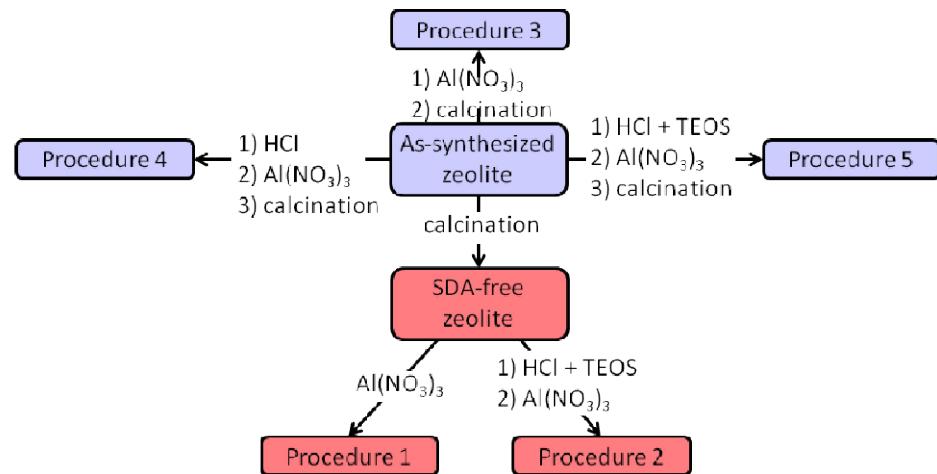
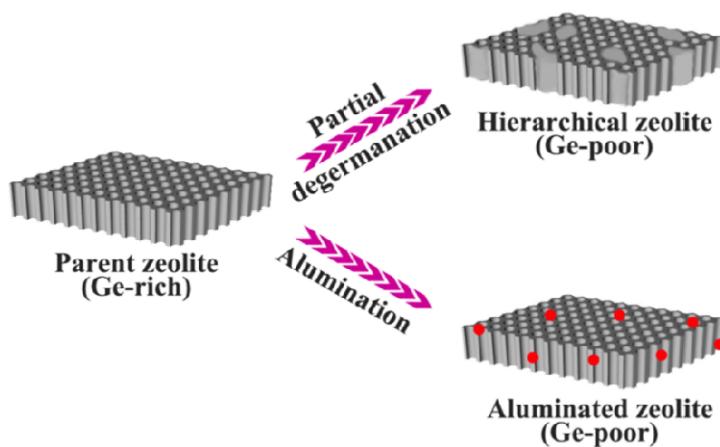
Swelling with $\text{C}_n\text{H}_{2n+1}\text{N}(\text{CH}_3)_3^+$



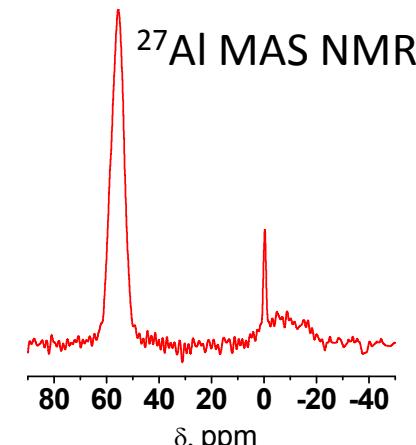
Pillars/layers "ratio"



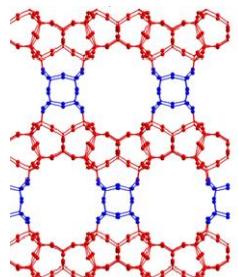
Against disassembly: stabilization and functionalization



Pore size	Zeolite	Procedure				
		1	2	3	4	5
Medium	ITH-13					
	ITH-2					
Large	IWW-7					
	IWW-3					
Extra-large	UTL-6		NMR			
	UTL-4					

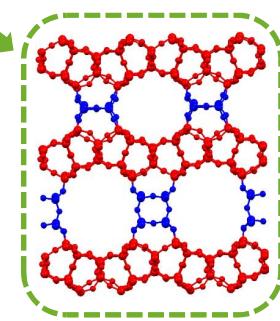


Isoreticular zeolites: application



UTL

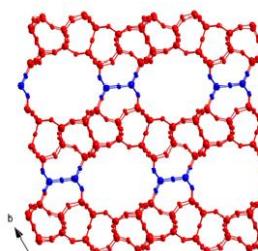
Conventional synthesis
 $\text{pH} > 10$



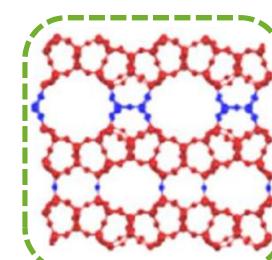
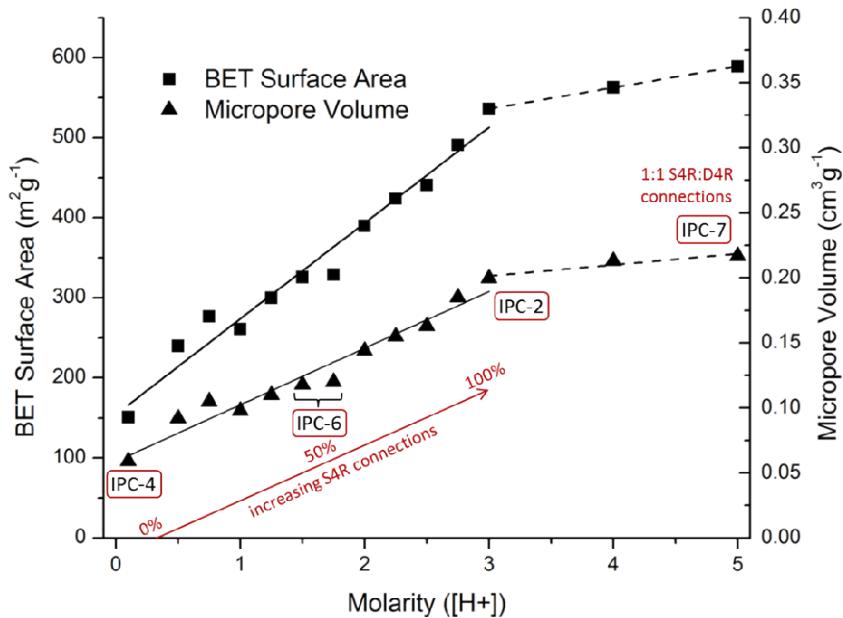
IPC-7

Post-synthesis
Al/deGe
 $\text{pH} < 3$

Same chemical composition ??
Similar crystal size ??

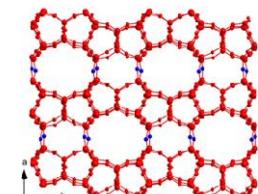


IPC-2
ADOR
 $\text{pH} < 0$



IPC-6

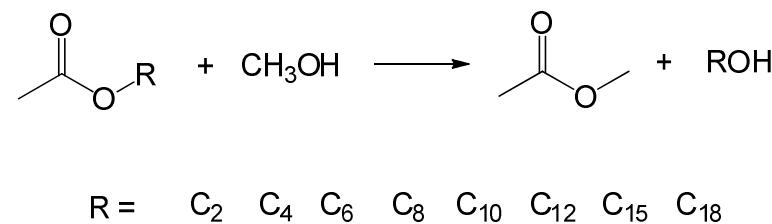
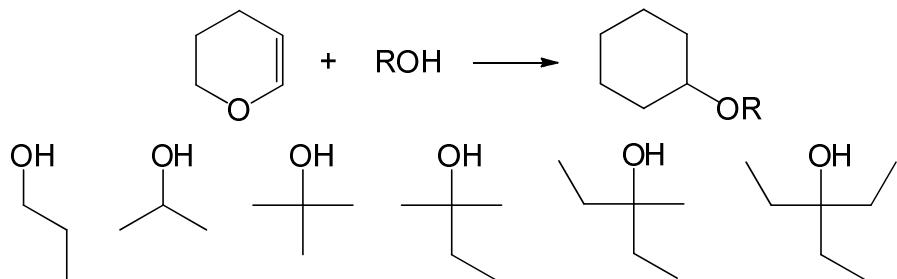
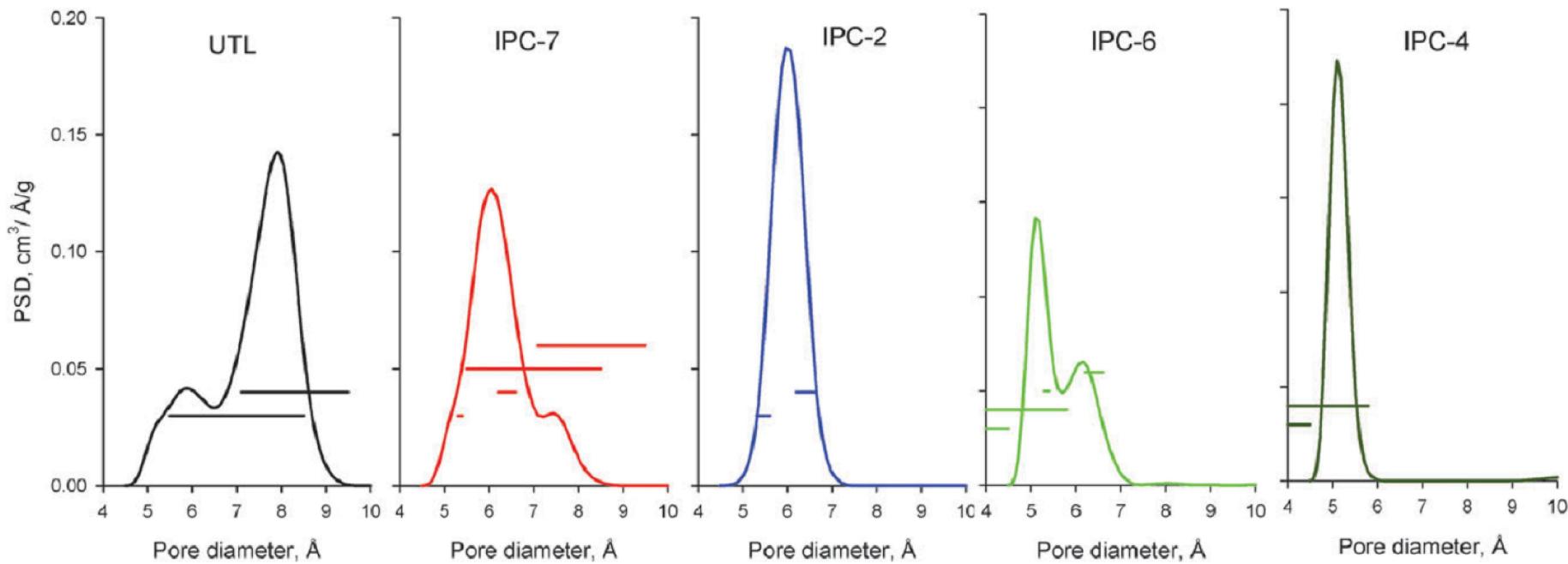
Post-synthesis
Al/deGe
 $\text{pH} < 3$



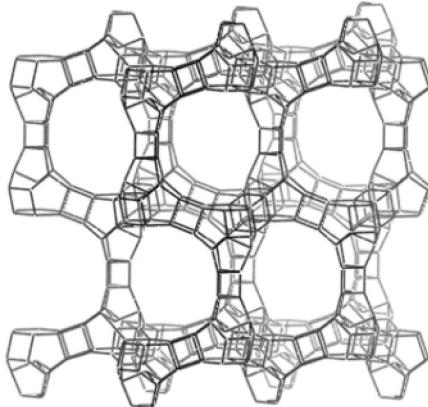
IPC-4

ADOR
 $\text{pH} \approx 7$

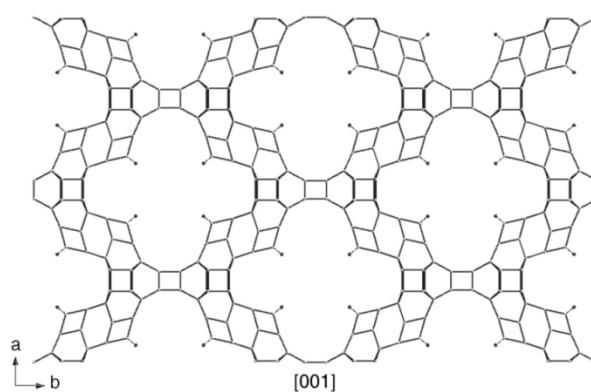
Isoreticular zeolites: catalysis



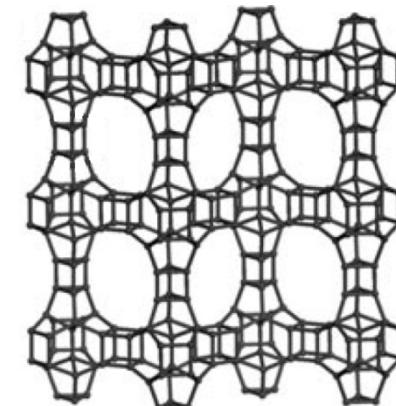
XL pore (> 16 MR) zeolites



16x15x15



28x12x12



18x12x12

- Synthesized in 2010+
- Contain D4Rs or D3Rs
- Fast synthesis
- Freestanding zeolites are not reported

Stabilization

- Direct or post-synthesis incorporation of heteroelements
- Less diffusion constraints
- Liquid-phase reactions involving bulky reactants
- Gas-phase reactions towards large-size products

Controllable degradation or recrystallization

Is it possible?

Thank you!