UNIVERSITÀ DEGLI STUDI DI PADOVA

Corso di studi in Scienza dei Materiali
A.A. 2022-2023
Dipartimento di Scienze Chimiche

Sintesi, struttura ed applicazioni dei materiali microporosi

Studente:

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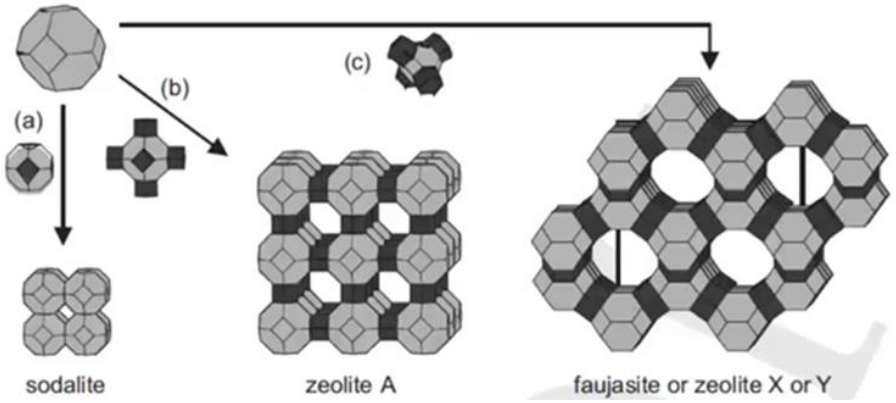
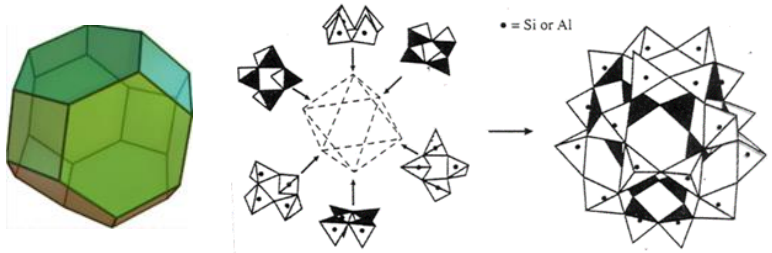
Relatrice:

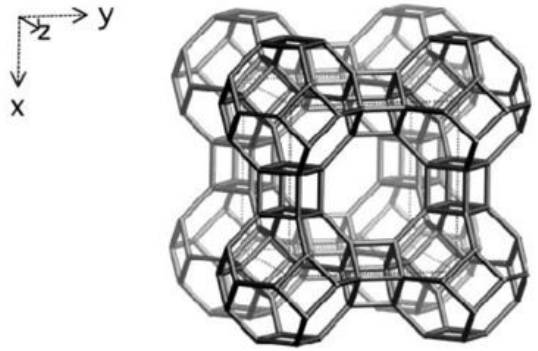
Antonella Glisenti

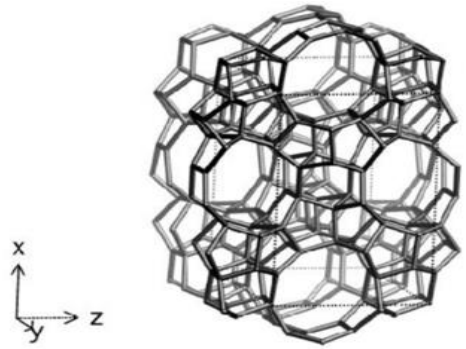
Zeoliti: Struttura

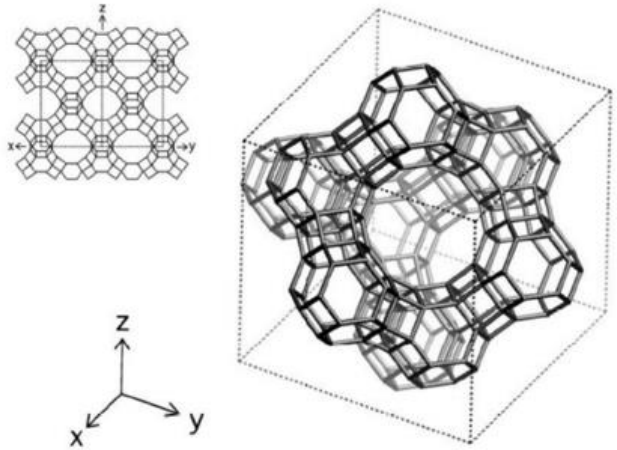
- sistema ordinato di canali e cavità
- Sodalite o β cage
- Classificazione sulla base della dimensione dei pori









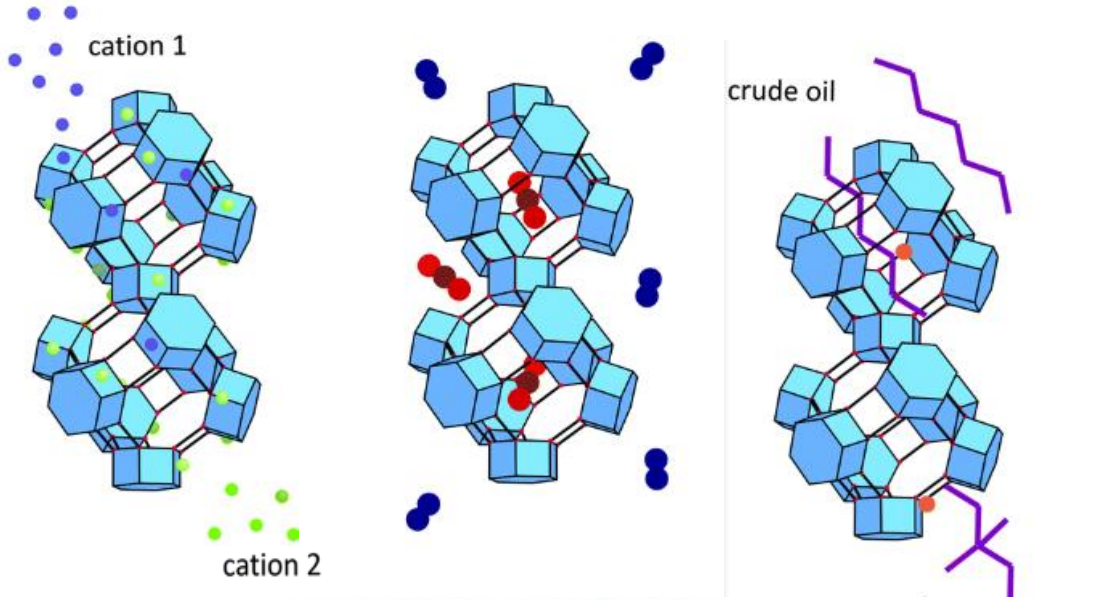


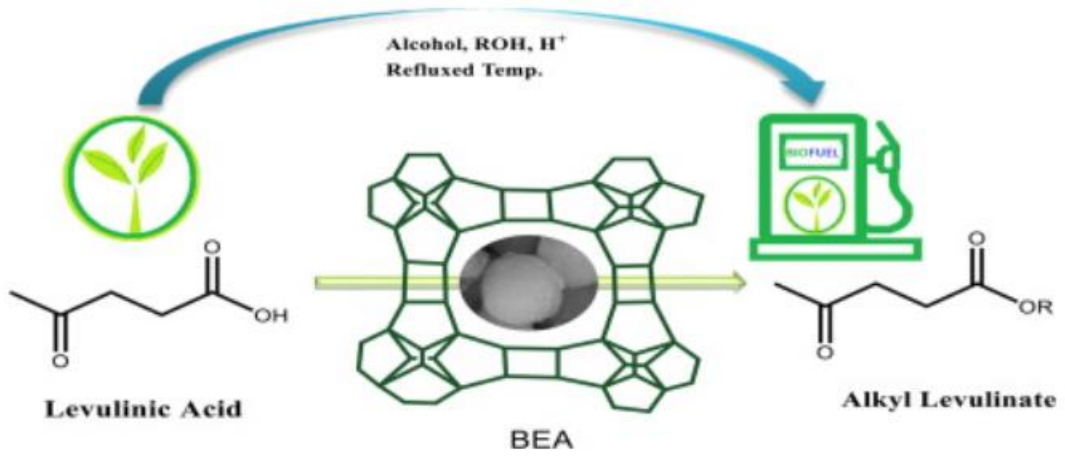
Zeoliti: Sintesi

- Preparazione del gel: partendo da soluzioni di silice e allumina
- Cristallizzazione de gel in condizioni idrotermali
- Controllo cinetico

Zeoliti: Applicazioni

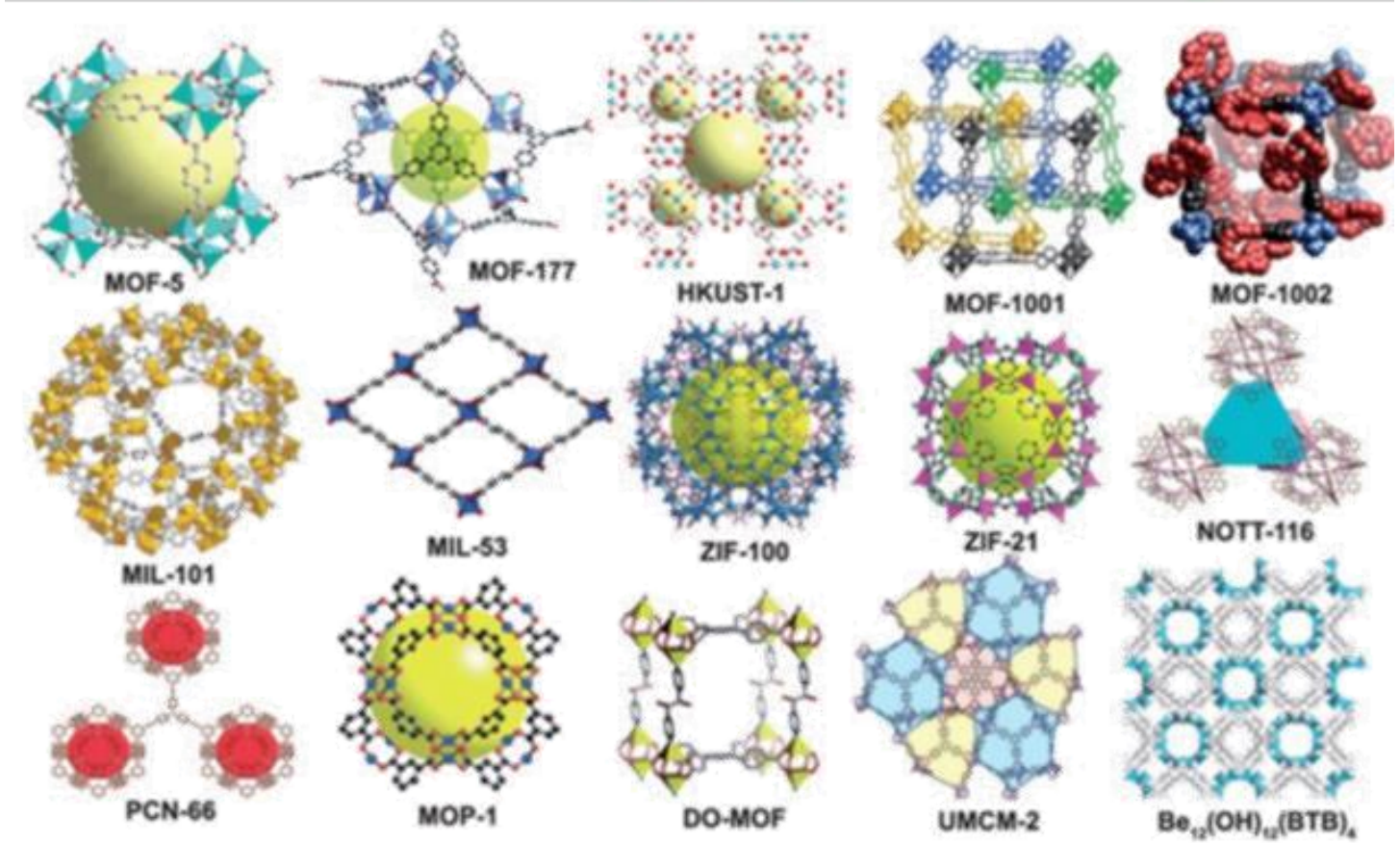
- Catalizzatori acidi
- Scambio ionico
- Setacci molecolari
- Catalisi selettiva





MOF: Struttura

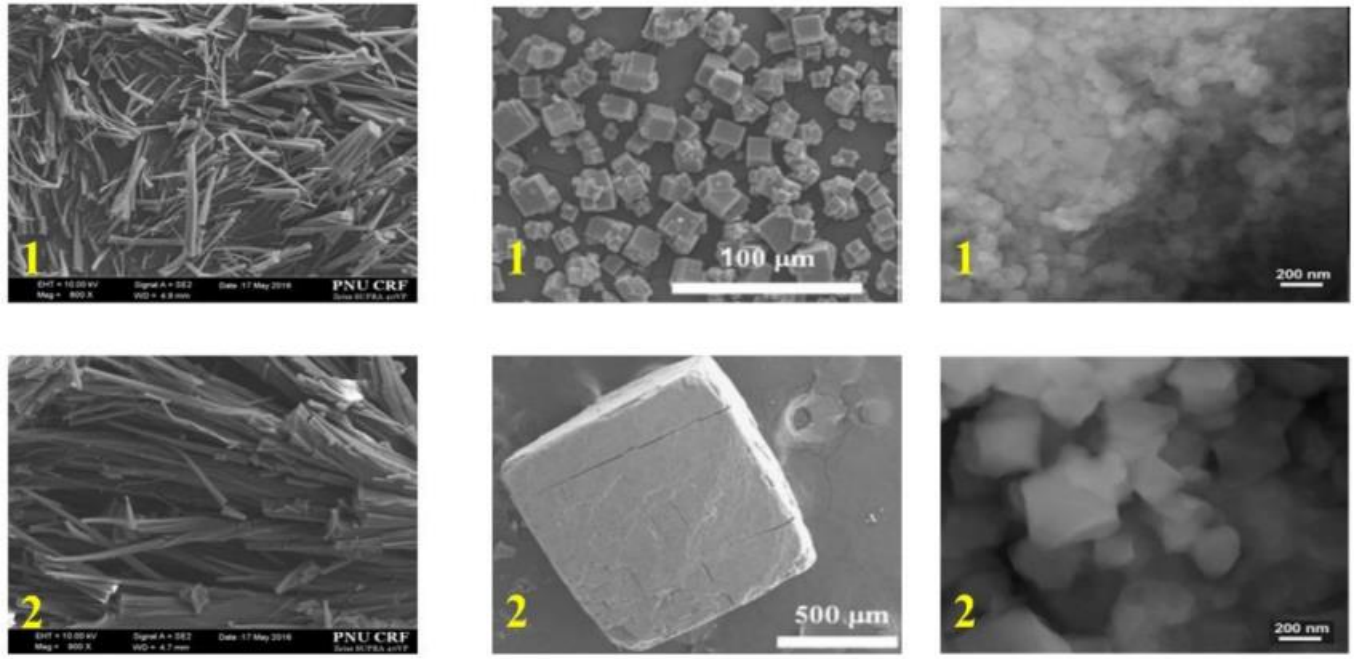
- Centri metallici (SBUs)
- Linker organici (strus)
- Topologia modulabile



MOF: Sintesi

- Processo solvotermale: partendo da precursori metallici e linker organici in solventi organici
- Alternative sintesi: meccanica-chimica, assistita con microonde o ultrasuoni
- Alternative sostenibile di sintesi a base acqua

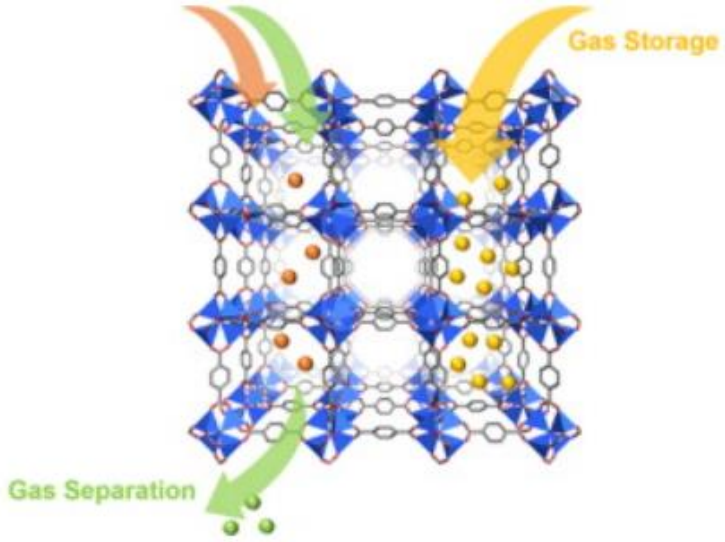
Microwave-assisted of UMCM-15 *Ultrasonic-assisted of* MOF-5 *Mechanochemical of MIL-101*

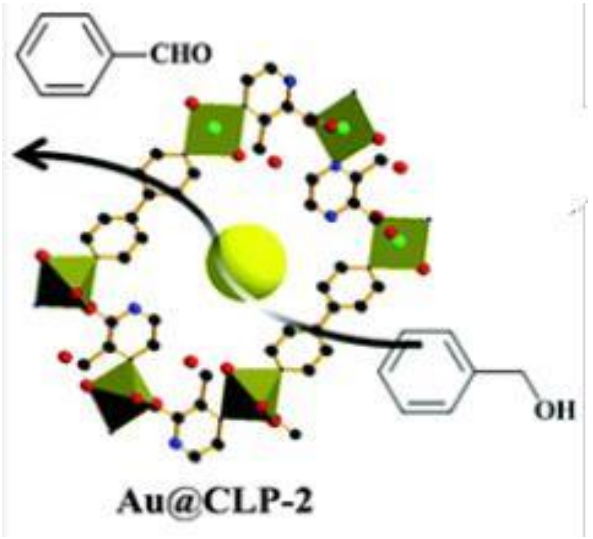


Solvothermal synthesis

MOF: Applicazioni

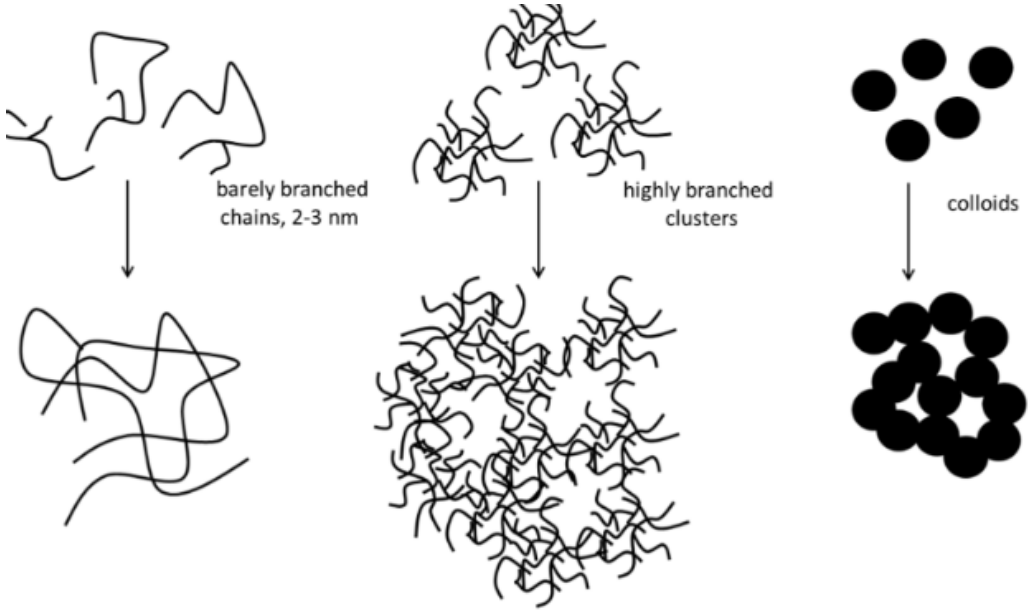
- Materiali assorbenti
- Separazione gas
- Catalisi
- Stoccaggio gas

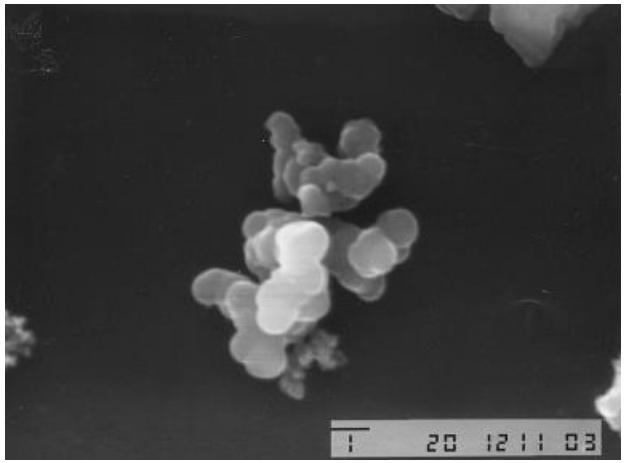


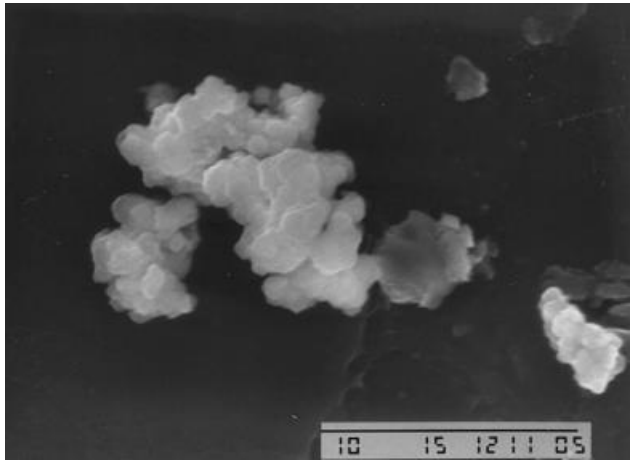


Gel di silice: Struttura

- Struttura amorfa
- Catalisi acida: Polimeri ramificati
- Catalisi basica: micelle





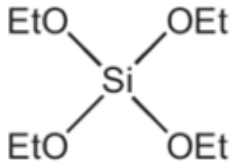


Gel di silice : Sintesi

- Silicati organici o inorganici con acidi
- Idrolisi e condensazione
- Invecchiamento del gel
- Eliminazione del solvente
- Trattamento termico
- Controllo delle porosità: pH e tempo di invecchiamento

$$\equiv Si—OR + H_2O \rightleftarrows \equiv Si—OH + ROH$$

$$\equiv Si—OH + HO—Si\equiv \rightleftarrows \equiv Si—O—Si\equiv + H_2O$$



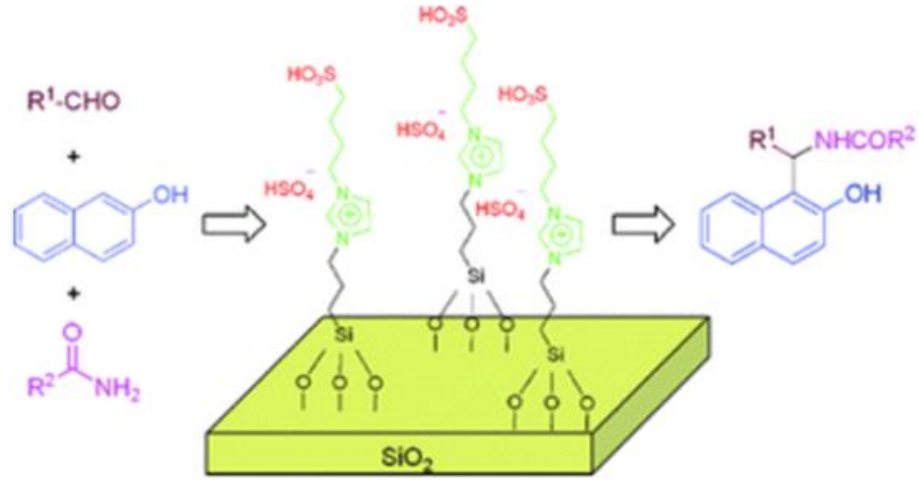
Tetraethoxysilane (TEOS)

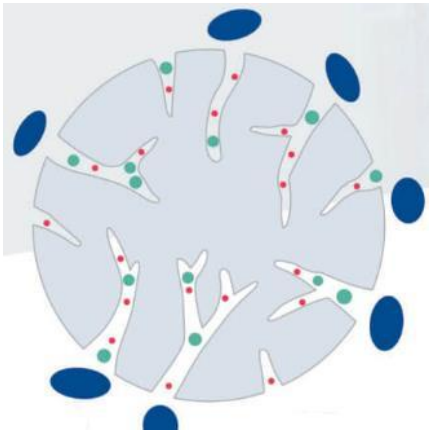
$(Na_2O)_x \cdot (SiO_2)_y$

Sodium silicate

Gel di silice : Applicazioni

- Adsorbente di acqua e sostanze polari
- formulazione di catalizzatori e supporti per catalizzatori
- processi di separazione
- Fase stazionaria in cromatografia

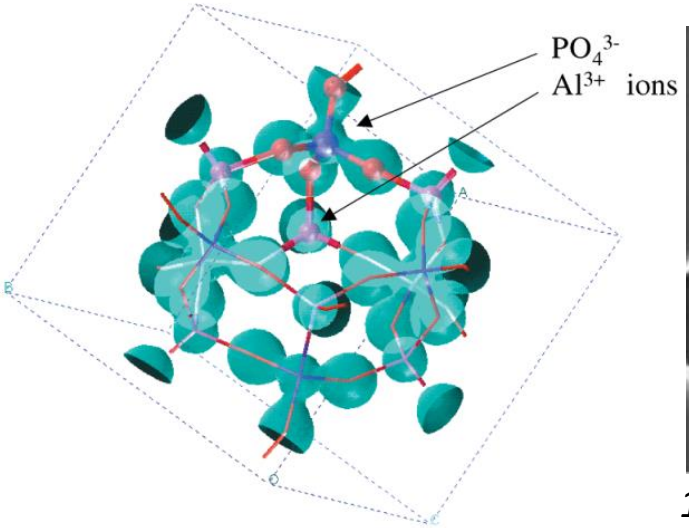


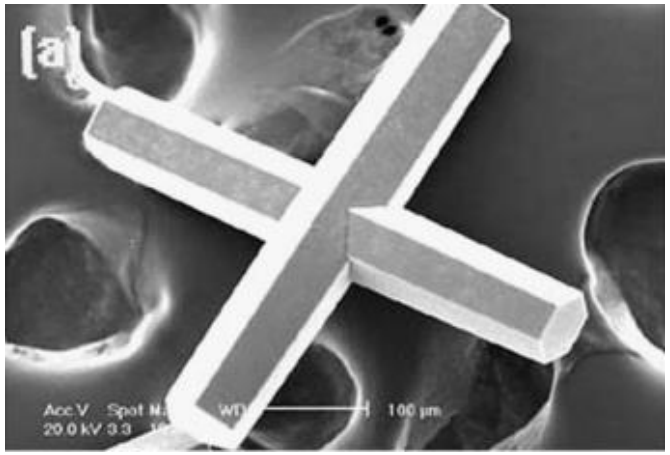


ALPO: Struttura

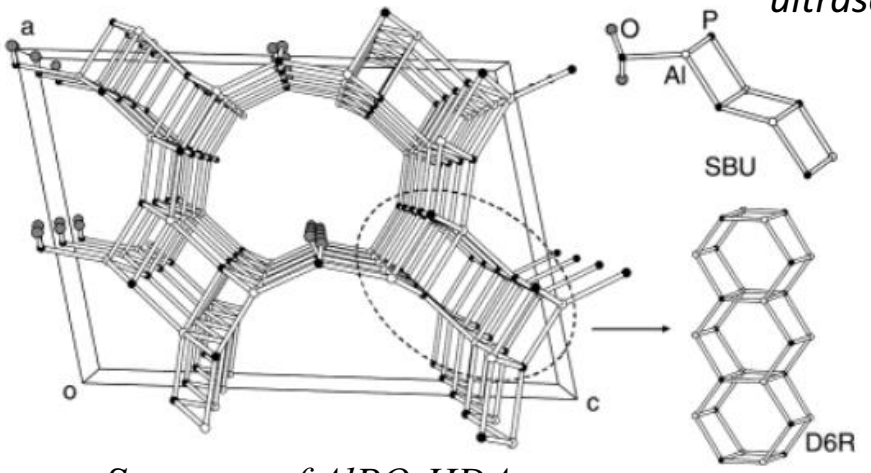
- Alternanza rigorosa di AlO4 and PO4
-
- open-framework neutro o anionico

- Struttura amorfa e AFI crystal





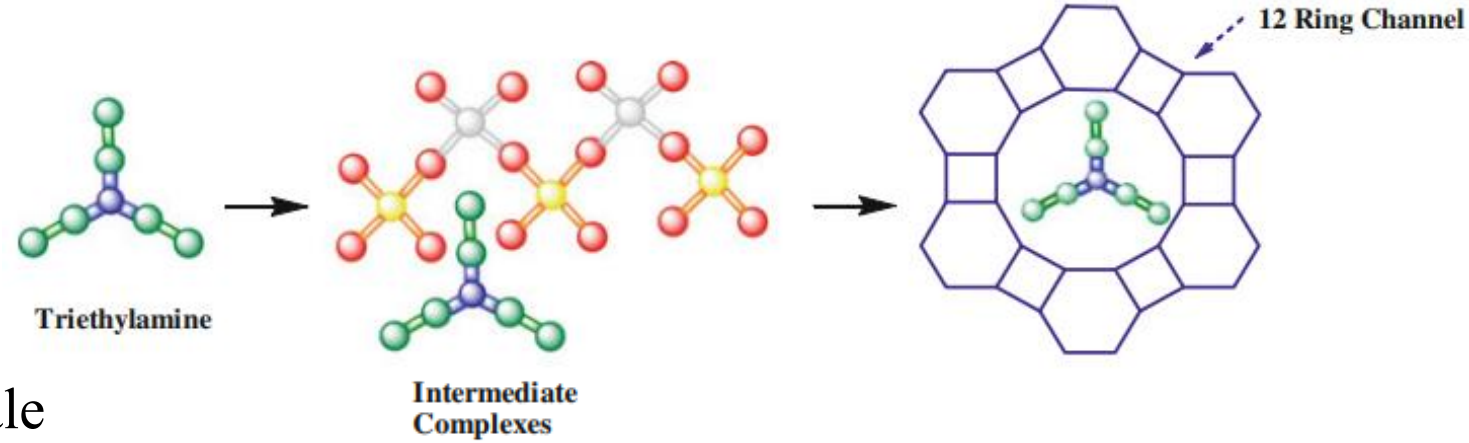
1,6TBAOH,adding of HF acid and with ultrasonic treatment

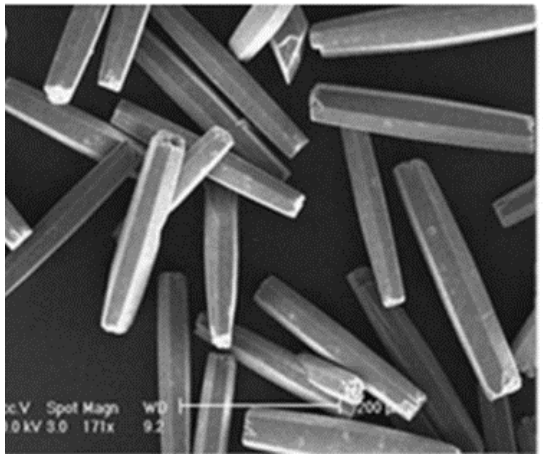


Structure of AlPO-HDA

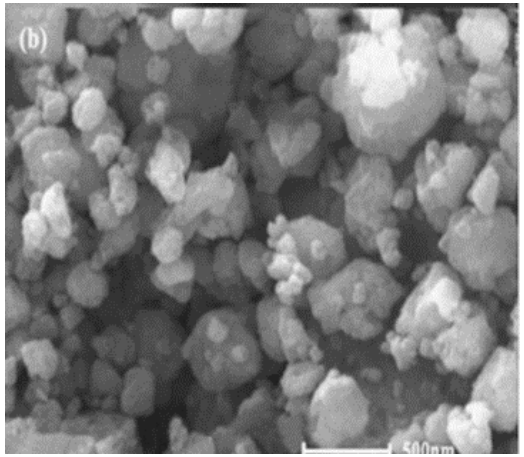
ALPO: Sintesi

- Preparazione de Gel a partire dai precursori (aggiunta di HF)
- Gel sottoposto trattamento idrotermale

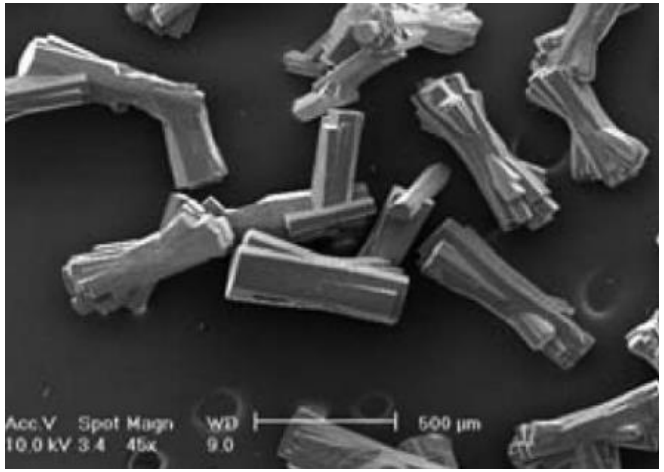




TBAOH e HF



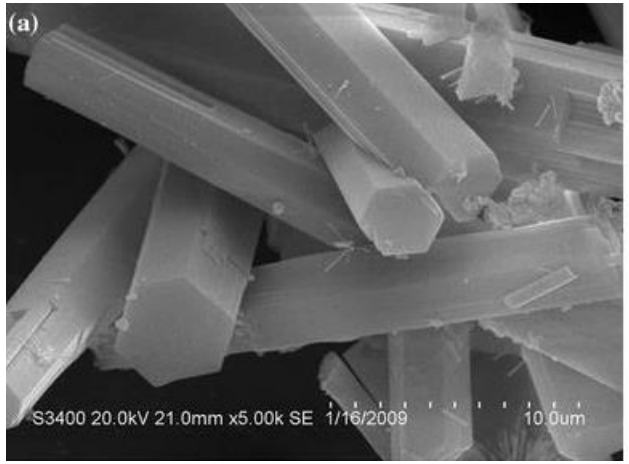
TEA, no HF

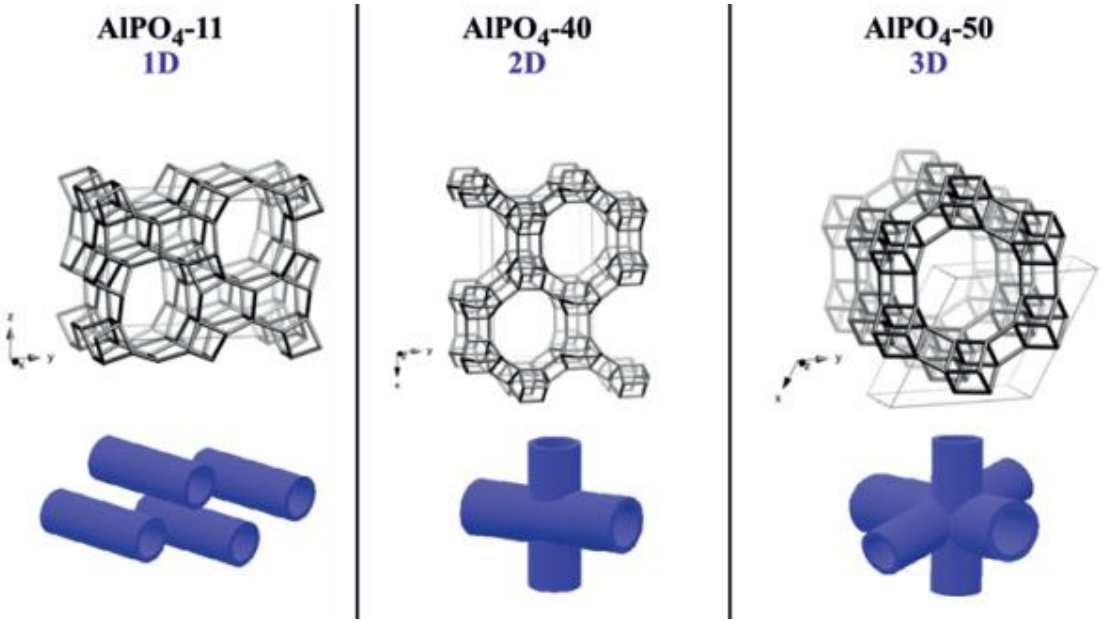


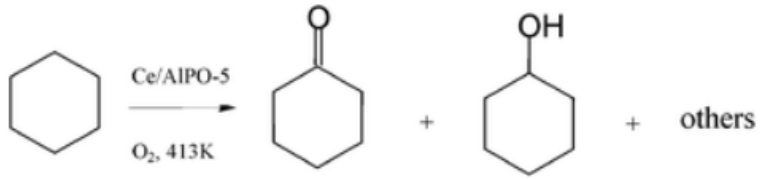
TPA e HF

ALPO: Applicazioni

- solvent-free industrial reactions
- Setacci molecolari
- Catalisi

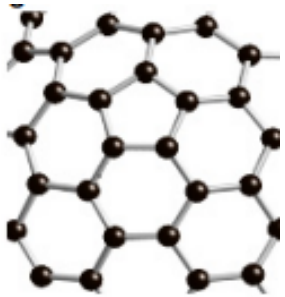


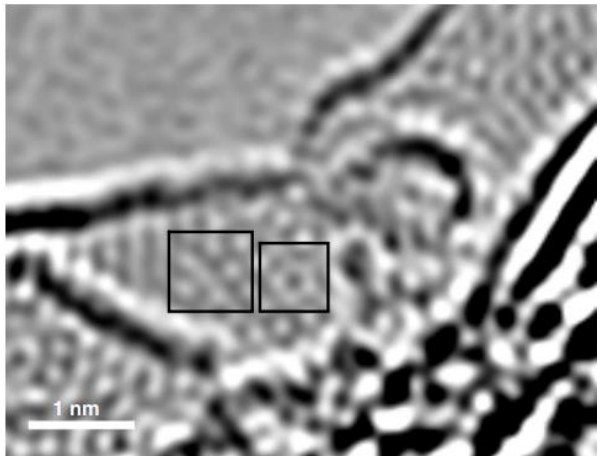


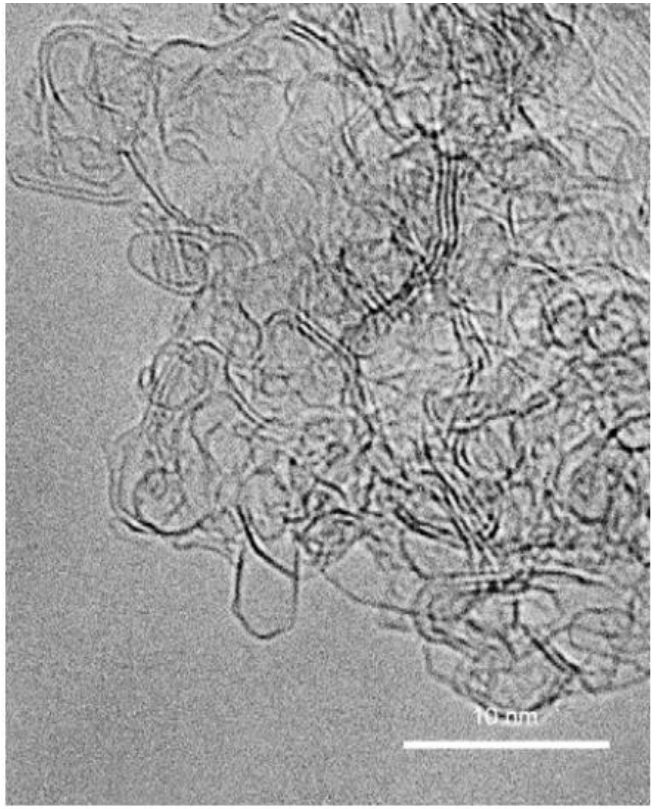


Carboni attivi: Struttura

- Porosità racchiuse da atomi di carbonio (slit-shaped)
- Forze di Van der Waalse responsabili del processo di adsorbimento
- Regioni a reticolo esagonale

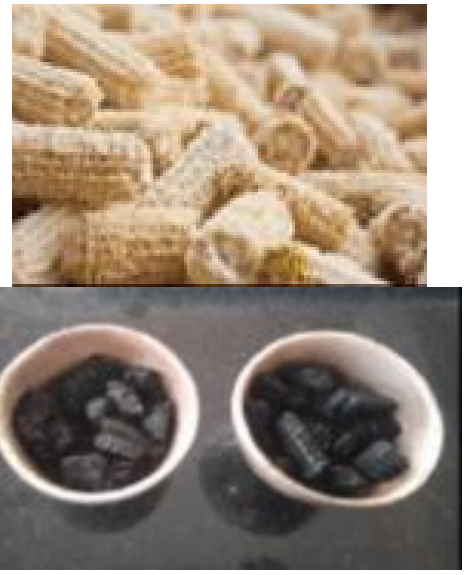






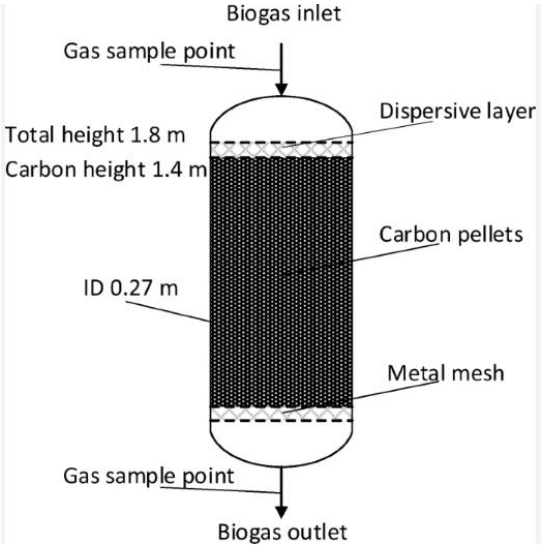
Carboni attivi: Sintesi

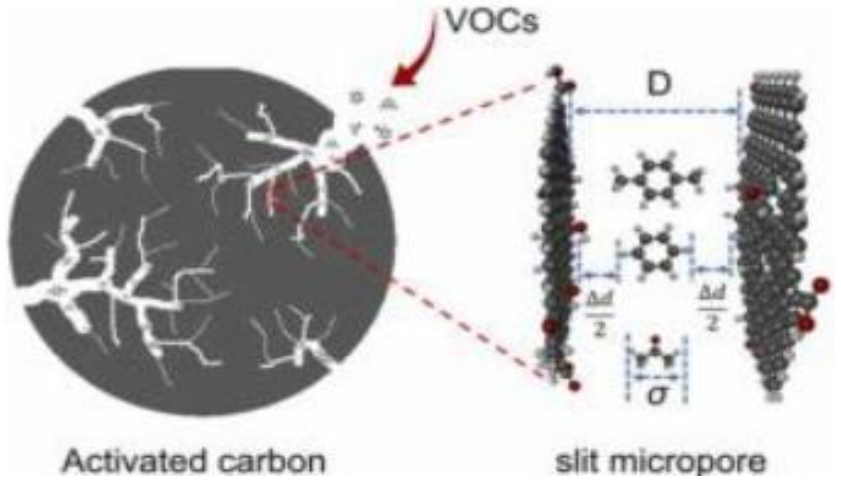
- Preparato da legna e vegetali (Hard woods, coconut shell, fruit stones, coals)
- Attivazione fisica: carbonizzazione e vapori ad alta temperatura o agenti attivanti (CO2)
- Attivazione chimica: reazione con un agente chimico (acido fosforico, ZnCl2)



Carboni attivi: Applicazioni

- Trattamento acque
- Abbattimento composti organici volatili
- Campo medico e alimentare
- Adsorbente dello zolfo nelle benzine





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