

AIZ-CIS-GIC Jointly Meeting 2019, 11<sup>th</sup> - 14<sup>th</sup> June, 2019



# BOOK OF FULL ABSTRACTS

Jointly Meeting of the  
Italian Zeolite Association (AIZ)  
Czech-Italian-Spanish (CIS) Conference  
Italian Interdivisional Catalysis Group (GIC)







## XVI National Congress of Zeolites Science and Technology



## 8<sup>th</sup> Czech-Italian Spanish Conference on Molecular Sieves and Catalysis



## XXI National Congress of Catalysis

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### *Book of Abstracts*

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# PROGRAM

TUESDAY, 11 <sup>TH</sup> JUNE	
14:30-16:00	Registration
16:00-16:30	Opening
16:30-17:15	PL1 - Giuseppe Bellussi: The energy transition towards a zero emission energy supply system (Chair: Girolamo Giordano)
17:15-18:15	Session Tu-1
17:15-17:35	O1 - PÉREZ-BOTELLA: Influence of zeolite framework topology in the CO <sub>2</sub> /CH <sub>4</sub> separation
17:35-17:55	O2 - GARBARINO: On the role of La <sub>2</sub> O <sub>3</sub> and SiO <sub>2</sub> in the formulation of Ni/Al <sub>2</sub> O <sub>3</sub> based CO <sub>2</sub> methanation catalysts
17:55-18:15	O3 - NACHTIGALL: Fast room temperature lability of aluminosilicate zeolites
18:15-18:55	Award's talks (Chairs: Giuseppe Cruciani and Fabrizio Cavani)
18:15-18:35	Premio Gottardi 2019 - CAMPANILE: Facile synthesis of nanostructured cobalt pigments by Co-A zeolite thermal conversion and its application in porcelain manufacture
18:35-18:55	Premio Parmaliana 2019 - FIORENZA: Modified TiO <sub>2</sub> -based catalysts for energy production and environmental protection
18:55-19:30	IL1 - Carlo Perego: Giuseppe Bellussi and zeolite science: a long history of success
20:00	Welcome Party
WEDNESDAY, 12 <sup>TH</sup> JUNE	
8:30-9:15	PL2 - Jiří Čejka: Adorable zeolites and catalysts (Chair: David Serrano)
9:20-10:40	Session We-1a (Chair: Domenico Caputo)
09:20-9:40	O4 - PAPANIKOLAU: Effect of a mild NH <sub>4</sub> OH treatment on local structure and acidic sites distribution of Fe-MFI
9:40-10:00	O5 - MARTÍNEZ ORTIGOSA: Silicalite synthesized by the dual-template technique: a solid state NMR study
10:00-10:20	O6 - ZANARDI: Crystalline hybrid organic-inorganic gallosilicates: synthesis and crystal structure
10:20-10:30	SO1 - PATEROVA: Use of Lewis and Brønsted acids as catalysts for β-pinene oxide rearrangement to prepare myrtenol and myrtanal
10:30-10:40	SO2 - SAJAD: Catalytic activity of noble metal clusters encapsulated in zeolites
10:40-11:00	Coffee Break
11:00-13:00	Session We-2a (Chair: Giovanna Vezzalini)
11:00-11:20	O10 - ALONSO-DONCEL: Tuning mesoporosity in hierarchical ZSM-5 zeolite by changing the silanization agent functionality
11:20-11:40	O11 - FABBIANI: Polymerization of hexadiene and phenylacetylene confined in silica zeolite channels
11:40-12:00	O12 - CAMETTI: Structural modifications and thermal stability of Cd <sup>2+</sup> -exchanged stellerite, a zeolite with STI framework type
12:00-12:20	O13 - COMBONI: High-pressure cold methanol intrusion in MFI-zeolites
12:20-12:40	O14 - KUBŮ: Encapsulation of metal nanoparticles (NPs) within zeolite frameworks via 2D to 3D transformation
12:40-12:50	SO5 - ERIGONI: Synthesis and characterization of organosiliceous hybrid materials containing acid functionalities
12:50-13:00	SO6 - LEO: Direct α-arylation of ketones efficiently catalyzed by Cu-MOF-74
11:00-11:20	O15 - BONELLI: Reverse micelles sol-gel synthesis allows both bulk doping and heteroatoms surface enrichment in Mo-doped TiO <sub>2</sub> nanoparticles
11:20-11:40	O16 - GUIDOTTI: Copper-containing microporous molecular sieves and organically modified clays applied in the defence against the olive tree fly pest
11:40-12:00	O17 - SANTACESARIA: Preparation of nanostructured catalysts by grafting metal alkoxides on the surface of oxides supports
12:00-12:20	O18 - STUCCHI: Post-synthesis modification of gold-silver nanoparticles: a way to tune catalytic activity and selectivity
12:20-12:40	O19 - Mino: Photocatalysis on shape-engineered TiO <sub>2</sub> nanoparticles: a closer look into the surface processes by in situ spectroscopies
12:40-12:50	SO7 - ARMANDI: Amphoteric surfaces stemming from the partial collapse of hybrid aluminosilicate nanotubes: an IR spectroscopy assessment
12:50-13:00	SO8 - CAVUOTO: Synthesis of biosurfactants by solid acid catalysts
13:00-14:00	Lunch
14:00-15:30	Free Time
15:30-17:10	Session We-3 (Chair: Joaquin Pérez Pariente)
15:30-15:40	SO9 - YUE: Multiple phase transformations during the synthesis of germanosilicate UOS
15:40-15:50	SO10 - BELVISO: Synthetic zeolite and laser effect: preliminary data
15:50-16:00	SO11 - ARDIT: The ferroelastic phase transition in ZSM-5 zeolites: chemistry vs. thermodynamic
16:00-16:20	O20 - BONURA: The key role of metal-zeolite interaction for stability of hybrid catalysts during CO <sub>2</sub> -to-DME hydrogenation
16:20-16:30	SO12 - PŘECH: Silica metal-oxide pillared zeolites – green selective oxidation catalysts
16:30-16:50	O21 - VILLAMAINA: Cu-CHA catalysts for NH <sub>3</sub> -SCR: the roles of SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> and Cu loading in the Cu-speciation
16:50-17:10	O22 - CAMPISI: Selective catalytic oxidation of ammonia (NH <sub>3</sub> -SCO) on iron beta zeolite catalysts prepared by ion exchange and solvated metal atom dispersion
17:10-19:00	Poster Session + Refreshments
19:00-20:00	General Assembly AIZ
19:00-20:00	General Assembly GIC
20:30	Dinner

THURSDAY, 13<sup>TH</sup> JUNE

8:30-9:15	PL3 - Avelino Corma: Inspiration from research and technology by ENI and G. Bellussi (Chair: Maksym Opanasenko)
9:20-10:40	Session Th-1
9:20-9:40	O23 - VESELÝ: Zeolites in Pechmann condensation: Impact of framework topology and type of acid site
9:40-10:00	O24 - CASTOLDI: Metal-doped zeolites for low-T NO <sub>x</sub> adsorption: operando FT-IR spectroscopy and reactivity studies
10:00-10:10	SO13 - GÓMEZ-POZUELO: Catalytic biomass pyrolysis over KH-ZSM-5 zeolite with acid-base properties
10:10-10:20	SO14 - CHENET: Adsorption of p-hydroxybenzaldehyde onto zeolites for water remediation: evaluation of the competition between contaminant and natural organic substances
10:20-10:30	SO15 - PALOMINO-CABELLO: Sulfonamides photodegradation assisted by $\alpha\text{Fe}_2\text{O}_3\text{-TiO}_2\text{-P}/\text{K}_2\text{S}_2\text{O}_8$ system
10:30-10:40	SO16 - CONFALONIERI: Dehydration of an azeotrope solution at high pressure through a differential penetration of ethanol and water in Si-chabazite
10:40-11:00	Coffee Break
11:00-11:30	IL2 - Adriano Zecchina: Contribution of spectroscopies to zeolites and microporous materials science (Chair: Silvia Bordiga)
11:30-13:05	Microsymposium Carlo Lamberti (Chair: Gloria Berlier)
11:30-11:50	KN1 - BORFECCHIA: Understanding selective redox chemistry in Cu-zeolites: a synchrotron-enhanced multi-technique perspective
11:50-12:10	O25 - VAN BOKHOVEN: In situ characterization of zeolitic catalysts
12:10-12:30	O26 - BUSCA: Cobalt metal catalysts in the hydrogen chemistry: support and preparation effects in CO <sub>2</sub> methanation and ethanol steam reforming
12:30-12:40	SO17 - GIGLI: New insights on the crystal structure of ZSM-12 with azonia spiro salts
12:40-12:50	SO18 - CROCELLÀ: Advanced spectroscopic characterization of acidic sites in hierarchically structured zeolites as catalysts for hindered substrates
12:50-13:00	SO19 - BELTRAMI: Neutron and <i>in situ</i> synchrotron x-ray powder diffraction analysis to study the thermal activation of NH <sub>4</sub> omega zeolite
13:00-14:00	Lunch
14:00-15:30	Free Time
15:35-16:50	Session Th-2 (Chair: Francesco Di Renzo)
15:30-15:40	SO20 - POLISI: First hints on pressure-induced amino acids condensation in mordenite
15:40-15:50	SO21 - BRUNDU: Thermal transformation of (NH <sub>4</sub> , Ba)-clinoptilolite to monocelsian, mullite, and cristobalite
15:50-16:00	SO22 - MANCINELLI: One-step deposition method for the synthesis of a nanocomposite membrane based on reduced graphene oxide/zeolite-A for adsorption of metal ions with enhanced antibacterial properties
16:00-16:20	O27 - GÓMEZ-HORTIGÜELA: Conformational sieving effect of ephedrine derivatives during the synthesis of zeolite materials
16:20-16:40	O28 - PIRONE: Nitrous oxide decomposition over copper-containing ZSM-5: unravelling the isothermal oscillatory behavior
16:40-16:50	SO23 - ATZORI: Mesoporous NiO-CeO <sub>2</sub> mixed oxides for CO and CO <sub>2</sub> co-methanation
16:50-20:00	Social Event
20:30	Dinner

FRYDAY, 14<sup>TH</sup> JUNE

8:30-9:05	IL3 - Suheil Abdo: Key role of zeolitic technologies in meeting current and future societal needs (Chair: Petr Nachtigall)
09:10-10:50	Session Fr-1
9:10-9:20	SO24 - VYSKOČILOVÁ: Solid acid catalysts for the direct hydration of dihydromyrcene
9:20-9:30	SO25 - ESPOSITO: Study of the effect of preparation procedure on the formation of active and stable ceria-zirconia supported molybdenum oxide catalysts for cyclooctene epoxidation
9:30-9:50	O29 - BELTRAMI: Mesoporous ZSM-5 loaded with amino acids: does secondary mesoporosity affect sorption capacity and thermal regeneration?
9:50-10:10	O30 - MAZUR: A kinetics study into the hydrolysis and intercalation processes within the ADOR mechanism
10:10-10:30	O31 - DIAZ: Ti-SBA-15 with tailor made pore size and particle morphology for epoxidation of vernonia oil
10:30-10:40	SO26 - CUMPLIDO: Synthesis of Al-rich ZSM-12 zeolite using a dabco derivative as a structure-directing agent
10:40-10:50	SO27 - PAPANIKOLAOU: Ni zeo-type catalysts for algal oil upgrading: role of acidity and active-site accessibility
10:50-11:20	Coffee Break
11:20-12:50	Session Fr-2 (Chair: Siglinda Peratoner)
11:20-11:40	O32 - GUTIÉRREZ-RUBIO: Guaiacol hydrodeoxygenation over Ni <sub>2</sub> P supported on 2D-zeolites
11:40-11:50	SO28 - BOCCIA: Alkali metals promoted Ru/Al <sub>2</sub> O <sub>3</sub> catalysts for CO <sub>2</sub> methanation
11:50-12:10	O33 - PIZZOLITTO: Effect of grafting solvent in the optimisation of SBA-15 acidity for levulinic acid production
12:10-12:30	O34 - LEO: Different activity and stability of Fe-containing MOF materials for fenton oxidation processes
12:30-12:40	SO29 - LÓPEZ-HERNÁNDEZ: CO catalytic oxidation reaction as a tool to evaluate the nature of Ag-catalysts
12:40-13:00	Final remarks





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## HIGH-PRESSURE COLD METHANOL INTRUSION IN MFI- ZEOLITES

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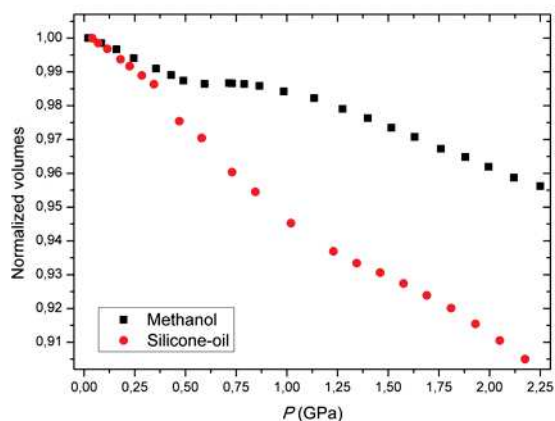
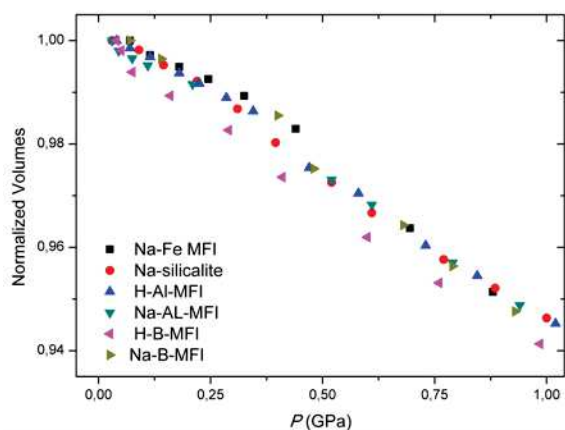
In the last decades, several efforts were devoted to explore the *P*-mediated intrusion of molecules in microporous compounds since this can lead to new routes of tailoring functional materials, bearing a potentially relevant technological impact. MFI-zeolites are also used as catalysts in some olefins-production processes, representing an appealing alternative to the high-energy demanding Steam Cracking process, which actually accounts for 95% of the total worldwide olefins production.<sup>1-3</sup> The applicative importance of MFI-type zeolites is due to their unique structure formed by (Al,Si)O<sub>4</sub> tetrahedra connected in such a way that a pore system, consisting of two intersecting channels, occurs within its zeolitic framework. The employment of zeolites as synthesis catalysts allows milder synthesis conditions, leading to a lower energy consumption and, therefore, lower greenhouse emissions. Furthermore, in recent years MFI-zeolites have been used in the promising methanol-to olefins synthesis process, which, being able to obtain olefins directly from methanol in place of oil bears a potential breakthrough industrial impact. It is worth to underline usually, at ambient conditions, only the surfaces of the zeolite crystallites are believed to be active in the methanol-to olefins process. However, induced by pressure, the methanol molecules may penetrate and diffuse through the zeolitic channels.<sup>4</sup> This may bear a significant impact in the industrial applications of this zeolite as a catalyst, since a “cold” intrusion of methanol into the zeolite cavities might pave the way to increase the efficiency of the methanol-to-olefins conversion process. In this regard, we synthesized and then studied, by *in situ* synchrotron X-ray powder diffraction experiments, the high-pressure behavior of six MFI-zeolites with different chemical composition (reported in Tab. 1). Consistently with the previous studies,<sup>5</sup> all the synthesized zeolites are monoclinic (space group *P*2<sub>1</sub>/*n*11) at ambient pressure, although a monoclinic-to-orthorhombic phase transition (MOPT) is reported to occur at *P* > 1 GPa.<sup>5</sup> Analyzing the pressure-volume data and the diffraction patterns, we were able to ascertain: *i*) all the MFI zeolites compressed in *silicone oil* have overall the same bulk compressibility (Fig. 1), *ii*) there are differences, among the different zeolites, in the magnitude of the methanol adsorption (*e.g.*, Fig. 2), *iii*) the MOPT is influenced by both crystal chemistry and sorbate (methanol) loading. Overall, this study provides useful information about the optimal chemical composition



of a potential MFI-catalyst in the methanol-to-olefins conversion process operating at high-pressure conditions.

**Table 1.** Chemical composition of investigated materials.

<i>Sample</i>	<i>Chemical fomula</i>	<i>Sample</i>	<i>Chemical fomula</i>
Na-Al-MFI	$\text{Na}_{2.51}\text{Al}_{0.81}\text{Si}_{95.19}\text{O}_{192}$	H-B-MFI	$\text{Na}_{0.02}\text{B}_{1.20}\text{Si}_{94.80}\text{O}_{192}$
H-Al-MFI	$\text{Na}_{0.05}\text{Al}_{0.87}\text{Si}_{95.13}\text{O}_{192}$	Na-Fe-MFI	$\text{Na}_{1.31}\text{Fe}_{0.89}\text{Si}_{95.11}\text{O}_{192}$
Na-B-MFI	$\text{Na}_{2.84}\text{B}_{1.35}\text{Si}_{94.65}\text{O}_{192}$	Na-Silicalite-1	$\text{Na}_{3.37}\text{Si}_{96}\text{O}_{192}$



**Figure 1.** (left) High-pressure evolution of the normalized unit-cell volumes of all the MFI-zeolites investigated using silicone oil as  $P$ -medium.

**Figure 2.** (right) High-pressure evolution of the normalized volumes of the H-B-MFI compressed in silicone oil (red spheres) and in methanol (black squares).

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