Waste-derived Silica-based porous solids for CO_2 methanation

Lidia Castoldi[1], Elisabetta Finocchio[2], Barbara Di Credico[3], Roberto Scotti[3], Luca Lietti[1], Cinzia Cristiani[4]*

[1] Dept. of Energy, Politecnico di Milano, Italy, lidia.castoldi@polimi.it, luca.lietti@polimi.it
[2]Dept. of Civil, Chemical and Environmental Engineering – DICCA, Università di Genova, Italy, elisabetta.finicchio@unige.it
[3]Dept. of Materials Science (DMS), Università degli Studi di Milano-Bicocca, Italy, barbara.dicredico@unimib.it, roberto.scotti@unimib.it
[4]Dept. of Chemistry, Material and Chemical Engineering (CMIC) "G. Natta", Politecnico di Milano, Italy, cinzia.cristiani@polimi.it

Lidia Castoldi

Abstract: To develop efficient and cost-effective CO_2 capture, storage and re-use systems, Mesoporous Silicas (MS) have been proposed due to their exceptional features. Compared to conventional porous silica, MS show extremely well-ordered pores, due to the nano templating method applied in their synthesis. MS surfaces, containing silanol groups, are the key factors for their performances, which can be further improved via functionalization with different molecules. Recently, industrial waste hexafluorosilicic acid H_2SiF_6 (FSA) has been proven to be a low-cost alternative for the synthesis of mesoporous silica that has confirmed its suitability as sorbent support, if functionalized to increase the affinity with CO_2. The captured CO_2 can be then stored or further converted to generate value added products (e.g. chemical and fuels), accordingly to the Carbon Capture and utilization (CCU) concept. This technology, that involves the conversion of waste CO_2 into added-value products by using renewable energy, is expected to have a strong impact in mitigating climate change.

What will audience learn from your presentation?

How the audience will be able to use what they learn?

- Application in Industry: The audience can apply the knowledge of advanced materials for CO2 capture in various industries, such as power plants, cement production, and chemical manufacturing, to reduce carbon emissions.
- Research and Development: Researchers and scientists can use the findings to develop more efficient and cost-effective materials, pushing forward the boundaries of material science and environmental engineering.
- Educational Purposes: Educators can incorporate the research findings into their curriculum, enhancing students' understanding of sustainable technologies and environmental solutions.

How will this help the audience in their job?

- Faculty and Researchers: This research can be used to expand their studies, leading to potential breakthroughs in CO2 capture and conversion technologies. Provides a solid foundation for interdisciplinary research, combining material science with environmental engineering.
- Industrial Designers and Engineers: Offers practical solutions for designing systems that efficiently capture and convert CO2, leading to more sustainable industrial processes. Can improve the accuracy of designing CO2 capture systems, ensuring they are both effective and economically viable.

In summary, my research on materials for CO2 capture and methanation offers numerous benefits across various sectors, from industry and policy to education and research. It provides practical solutions, promotes technological advancement, and supports environmental sustainability.

Biography of presenting author

Prof. Lidia Castoldi graduated in Industrial Chemistry and takes her PhD in Industrial Chemistry and Chemical Engineering at Politecnico di Milano. Her scientific activities have been developed in the field of catalysis for

environmental protection, i.e. advanced materials for CO_2 capture and conversion (i.e. methanation reaction, waste-derived materials as new raw materials), H_2 production from fossil (and renewable) fuels (i.e. turquoise H_2 production), catalytic processes for NO_x and soot abatement, advanced materials for catalytic decomposition of liquid monopropellant for space applications, interaction between surface reactions and gas phase reactions, coating formulation for metallic and/or ceramic materials of different geometries. In this contest, she developed a specific expertise on different aspects of heterogeneous catalytic processes, as preparation and characterization of heterogeneous catalysts, reactivity, reaction mechanisms and kinetic aspects of the reactions.

Details of presenting author to be mentioned in certificate:

Name: Lidia Castoldi
Affiliation: dept. of Energy – Politecnico di Milano
Country: Italy

Other Details:

Presentation Category: Oral
Session Name: Catalytic Materials & Green Chemistry or Materials for Energy and Environmental Sustainability
Email: lidia.castoldi@polimi.it
Contact Number: +39 02 23993255
LinkedIn: https://www.linkedin.com/in/lidia-castoldi-745b5b58/
Website: https://www.silco.polimi.it/; https://www.lccp.polimi.it/

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