



Consiglio Nazionale delle Ricerche

Venerdì, 28/05/2021

alle ore 11.30

il **Dr. Francesco Barzagli**

CNR-ICCOM

Firenze

terrà il seguente seminario:

"Innovative methods with low energy consumption for efficient CO₂ capture & utilization processes"

Il seminario sarà tenuto in modalità telematica, tramite accesso alla piattaforma GoToMeeting.

Si invitano tutti gli interessati a partecipare.

Dr. Francesco Vizza
Direttore ICCOM

Short Abstract:

The increasing concentration of CO₂ in the atmosphere and the growing concern for related global climate change have recently focused interest in the development of carbon capture utilization and storage technologies (CCUS), as potential methods to reduce greenhouse gas emissions. Among the different CO₂ capture techniques, chemical absorption based on aqueous amines is considered the most mature technology for industrial scale application, and in particular aqueous 2-aminoethanol (MEA) has a long story as efficient system for CO₂ separation in natural gas extraction and gas refinery. However, MEA technology suffers some critical limitations that prevent its wide application, mainly related to the high energy cost of sorbent regeneration and environmental concerns because of the thermal and oxidative amine degradation.

The aim of my research activity is the development of new and efficient systems for the capture of CO₂ from a gas stream in a sustainable way from an energetic, economic and environmental point of view. To achieve this goal, two main strategies were followed. The first strategy concerns the formulation of alternative amine sorbents, or even new classes of sorbents, able to outperform the conventionally used aqueous amine in terms of CO₂ absorption rate, cyclic capacity and regeneration heat requirement. The study has been focused on amines (or amine blends) which combine high CO₂ reaction rate with a low energy for regeneration. Moreover, the strategy of replacing water, the most energy-hungry component in the conventionally used amine sorbents, with organic diluents that have considerably lower heat capacity and heat of vaporization was also considered. The replacement of water by organic diluents, or the absence of any diluents, may also redirect the reaction of amines with CO₂ towards less stable species which, consequently, require lower stripping temperatures at room pressure. The other strategy pursued concerns the development of a new concept of CO₂ capture and utilization process, which combines the CO₂ abatement with the direct synthesis of commercially valuable products. Turning carbon dioxide into useful chemicals under mild operating conditions can circumvent most of the drawbacks of the energy-intensive processes of CO₂ desorption, sorbent regeneration, CO₂ transport and final disposal. With this approach, CO₂ is no longer seen as a waste, but rather as the building block for obtaining valuable chemicals that can lower the cost of the capture itself.

Short Biography:

Francesco Barzagli received his degree in Chemistry (2006) and his PhD in Chemical Sciences (2016) at the University of Florence. After a short period as an analytical chemist, he turned his interest to the study of "CO₂ capture utilization and storage technologies" (CCUS). From 2007 to 2018 (including the PhD period) he worked at the University of Florence, in collaboration with ICCOM-CNR, under the supervision of Prof. Fabrizio Mani and Dr. Maurizio Peruzzini. In particular, he focused his research activity on the development of aqueous and organic sorbents for the selective capture of CO₂ from different gas mixtures (flue gas, natural gas, biogas) and on the development of sustainable processes for the conversion of CO₂ in useful chemicals (urea, disubstituted urea, precipitated calcium carbonate, basic zinc carbonates) in mild conditions. During this time, he has been involved in several scientific and industrial projects, both as a team member and as a principal investigator, aimed at transferring the technology developed in the laboratory to medium-sized pilot plants.

Since December 2018 Francesco Barzagli is a permanent researcher at ICCOM-CNR in Florence, where he is currently dedicated to the study of direct CO₂ capture from air (DAC) and to the development of solid acid catalysts to reduce the energy required in the sorbent regeneration processes. His recent international scientific and industrial collaborations include King Abdullah University of Science and Technology (Saudi Arabia), Casale SA (Switzerland), University of Jordan (Jordan), Xiangtan University (China) and Korea Institute of Energy Research (South Korea).

Francesco Barzagli (H-index=16) is author and co-author of 24 scientific papers on international ISI journals, 1 book with ISBN, 1 book chapter, 1 technical report, and over 30 contributions to national and international conferences as poster and oral communications.