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Thursday, July 7th, 2022, 14-15 CET

WEBINAR

Gas specifications for CO_2 transport

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Speakers

Manuele Gatti – professor, LEAP / Politecnico di Milano

Daniele Di Bona - professor, LEAP / Politecnico di Milano

Lan Liu, PhD – senior research scientist, IFE Institute for Energy Technology

Q&A session chaired by:

Valentina Volpi, researcher Geophysics Dept., OGS

Alberto Pettinau, Head of Research and Development, Sotacarbo

WHAT WILL YOU LEARN

Thermophysical properties of CO_2 mixtures and their relevance to CO_2 capture, purification and transportation.

Improving the knowledge on the thermodynamic behavior of CO_2-rich mixtures is still an open topic of research in the field of CO_2 Capture, Utilisation and Storage. Depending on the technology and industrial sector, captured CO_2 streams may include a range of different impurities which may impact the design of CO_2 capture and purification units (e.g. in oxyfuel applications), the definition of CO_2 quality specifications for transportation and utilization/storage and even the calibration of CO_2 flow metering tools. As a result, more experimental data and improved calibrated models (Equations of State and thermophysical properties correlations) are needed for a proper description of the thermodynamic behavior of CO_2-based mixtures, supporting the design of the CO_2 transportation step.

In this webinar, an overview of the research status and needs on thermophysical properties of CO_2 mixtures with particular focus on their impact on CO_2 transportation will be presented by LEAP and Politecnico di Milano researchers. Moreover, LEAP's experimental facilities (CO_2_box) for VLE and density measurement of CO_2-based mixtures will be described and relevant research activities recently performed for the characterization of thermophysical properties of fluids will be presented.

FALCON: A Versatile Flow Assurance Loop for Studying Important CO_2 Transport and Well Injection Phenomena

CO_2 transport and well injection are the essential links between carbon capture and the final storage. A significant amount of research has demonstrated the feasibility of CCS but has also highlighted challenges to its practical implementation. One of the challenges is the flow assurance issues during CO_2 transport and well injection that could jeopardize the integrity of the system, such as flow instability, plugging by accumulation of dry ice and hydrate, vapor collapse, impurity impact on phase envelope, etc. This often leads to excessive safety margins in the design of CO_2 systems. Thus, this calls for continuous development and implementation of innovative technologies (e.g., flow simulator technology) based on the knowledges and competences built up from high-quality research. IFE's FALCON loop has been designed and used to perform research for ensuring a safe and cost-effective CO_2 transport and injection for operation of CCS infrastructures. The facility is equipped with advanced instruments for control of input parameters and for characterization of the flow, with emphasis on crucial phenomena. FALCON facility has contributed to closing knowledge gaps through, for example, producing high-quality and relevant data on multiphase flow, phase slip, pressure drop, effect of impurities on phase transition during depressurization, wellhead choking, heat transfer, shut-in and re-start processes, etc.

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ECCSEL ERIC (European Research Infrastructure Consortium) was established in June 2017 as a permanent pan-European distributed research infrastructure, with the main objective of enhancing European science, technology development, innovation and education in the field of CCUS, in orderto combat climate change.

ECCSELERATE project is aimed at increasing the accessibility to the excellent network of facilities already established in ECCSEL ERIC for a wider user group, part of the research and industrial community.

KEYNOTE SPEAKERS

Manuele Gatti
PhD in Energy, Assistant Professor of Energy Systems at Politecnico di Milano (Department of Energy) teaching two courses at the Master of Science level. He has extensive experience in the field of process design and techno-economic assessment of CO_2 capture technologies, developed both in the framework of European projects and industrial collaborations. Author of several papers and three patents in the field of CO_2 capture. His research interests focus on: process design and modelling of CO_2 capture technologies, thermodynamic properties characterization and modelling of fluid mixtures, biofuel production processes and advanced energy systems (e.g. novel thermodynamic cycles, heat pumps).

Daniele Di Bona
senior scientist at LEAP research centre, manages the Waste-to-Value area that promotes and studies energy efficient, low carbon and environmentally friendly solutions for a sustainable waste management. He manages LEAP's H&S services and he is also in charge of the "CO_2_box", a test laboratory on thermodynamic properties of fluids. He has been awarded a M.Sc. in 2006 and a Ph.D. in 2010 in Mechanical Engineering with both theses on innovative energy conversion systems. Since 2012 he collaborates with Politecnico di Milano, Department of Energy, as a teaching assistant for the courses of Fluid-Machines, Energy Systems and Low-Carbon Technologies. With over fifteen years of working experience, he has been involved in a wide variety of public and private research projects and consultancies, from test benches design and construction, coordination of performance tests and experimental campaigns at industrial sites, to modelling and studying of innovative energy systems (e.g., Waste-to-Chemicals, CCUS, Heat Pumps, etc.). His scientific activity is focused on fuel cells, CO_2 capture technologies, thermodynamic properties of CO2-based mixtures and waste valorisation routes.

Lan Liu
is a senior research scientist at Institute for Energy Technology (IFE), Norway. She has more than 20 years experiences on experimental research for multiphase flow for both CCS and Oil & Gas applications. She has been one of key researchers for several major industrial and Norwegian Research Council projects for research and infrastructure. Her research interests are focusing on flow assurance for CO_2 and Oil & Gas transport pipelines, such as experimental investigations on the multiphase flow, advanced instrumentation for multiphase technology, heat transfer, rheology, hydrate, etc.

WHAT IS CCUS?

Carbon capture, utilisation and storage, or CCUS, is an important emissions reduction approach that can be applied across the energy system, in both power generation and industrial sectors.

CCUS encompasses methods and technologies to remove CO_2 from the flue gas and from the atmosphere, followed by recycling the CO_2 for utilization and determining safe and permanent storage options:

- **Capture** technologies allow the separation of CO_2 from gases produced in electricity generation and industrial processes.
- After capture, carbon dioxide must be **transport**ed to the storage or utilization site. CO_2 is an inert gas and can be easily handled and transported in high-pressure pipelines. Alternatively, it can be transported in industrial tanks by ship, rail and truck.
- There are several possibilities for long-term CO_2 **storage** in safe conditions. Generally, CO_2 is stored in carefully selected geological rock formations that are typically located several kilometres below the earth's surface.
- **Utilization** technologies allow to use CO_2 to make valuable products, such as clean fuels, building materials or consumer goods. A clear example of circular economy, where the CO_2 becomes a raw material rather than a waste by-product.