

Chemical Looping Combustion for CO₂ Capture

(20 – 24 November, 2017)

Department of Chemical Engineering, NIT WARANGAL

1. Overview

Global warming is a major concern in most of the developed countries and also in developing countries such as India. Most of the current day energy needs are met by burning fossil fuels, which release carbon dioxide (CO₂) into the atmosphere. Carbon dioxide is one of the greenhouse gases that leads to global warming; hence, it is very vital to capture and store/utilize the carbon dioxide. Chemical looping combustion (CLC) is an inherent carbon dioxide capture technology. In this technology, a metal oxide is used to supply oxygen to the fuel to be burnt. The system consists of two reactors—fuel reactor, where oxidation of fuel occurs with the help of oxygen available in the form of metal oxides and air reactor, where the reduced metal oxides are regenerated by the inflow of air. This process results in combustion of fuel and production of two gas streams one being rich in carbon dioxide and the other rich in nitrogen. CLC is a very promising technology and holds the key to the future of low-cost CO₂ capture technologies. However, the scale-up will depend on availability of highly efficient and economically viable oxygen carriers. This workshop is mainly aimed at giving fundamentals as well as the current research trends in the area of Chemical looping combustion and the preparation of oxygen carriers.

The course is well organized in terms of the lectures covering the Principles and Thermodynamic aspects of Chemical Looping Combustion, Properties of oxygen carriers, preparation of oxygen carriers, chemical looping gasification, Designs of CLC, Operation of CLC units, and CLC integrated Power plant simulations. These lectures will be complimented with necessary hands-on sessions and demonstrations.

This course is organized in the form of nineteen hours of lectures and five tutorials/hands on sessions spread over five days. Course participants will learn these topics through lectures, tutorials and assignments. A graded examination will be conducted on the last day of the course.

Leading international academics and researchers with extensively recognized expert, and demonstrable ability in teaching, consultancy, research, and training in the field of chemical looping combustion will deliver lectures and discuss the latest trends in the course.

2. Objectives

On completion of the training, participants will be able to:

- i) Understand the concept of chemical looping combustion for CO₂ capture
- ii) Understand the preparation and characteristics of oxygen carriers
- iii) Understand the chemical looping gasification
- iv) Understand the designs of CLC units
- v) Understand the application of CLC in power plants

Dates	20 – 24 November, 2017
Modules	<ul style="list-style-type: none"> ▪ Introduction to Chemical Looping Combustion – Fundamentals & Applications ▪ Selection and Characteristics of Oxygen Carriers ▪ Fuel Chemistry in CLC ▪ Design of power plant with CLC ▪ Economics and novel applications of CLC
You Should Attend If...	<ul style="list-style-type: none"> ▪ you are a faculty member/research scientist/ industry professional working or interested in CO₂ Capture and Utilization (CCU) ▪ you are a professional working in thermal power plants. ▪ you are a UG/PG student or research scholar interested / working in CCU technologies.
Fees	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad : US \$ 300 Industry/ Research Organizations: Rs. 10,000/- Faculty: Rs. 4,000/- Students & Research Scholars: Without award of Grade: Rs. 1,000/- With award of Grade: Rs. 1,500/-</p> <p>The above fee includes all instructional materials, computer use for tutorials and assignments. The participants from academic/research institutes and Industry will be provided with boarding and lodging on additional payment of Rs. 4,000/- in Visitors Block on twin sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels (DASA) on additional payment of Rs. 2,500/-. Please note that, accommodation inside NITW campus is very limited and same will be provided to participants on first-cum-first-serve basis. The accommodation facility is basic in nature. You can contact coordinators if you are interested in opting for better accommodation in nearby hotels on payment basis. Also, note that, if you are working in academia/industry and pursuing PhD, you are required to register under Faculty/Industry category and not as a student.</p>

The Faculty

	<p>Dr. Henrik Leion is Associate Professor in combustion chemistry at the division for Chemistry and Biochemistry in the field of Chemical-looping combustion (CLC) and gasification His research focus includes development of new oxygen carriers and investigation of the chemical reactions of fuel and oxygen carriers in CLC and gasification. Henrik has over 60 journal publication dealing with CLC and oxygen carriers, 6 of them with over 100 citations, making him one of the world top cited researchers in the field. Chalmers University of Technology in Sweden is the world leading institution for CLC research. He has been involved in supervision of 16 Phd-students and over 25 master students and is a frequent reviewer in 10 different journals. Henrik is the director of the master program 'Material Chemistry' at Chalmers and has lifted a number of significant grants, such as National Energy grants. He has also received a few rewards for his research, where the most prestigious is "Stiftelsen Konung Carl XVI Gustavs 50-årsfond för vetenskap, teknik och miljö" given from the hand of his majesty king Carl XVI Gustav of Sweden. For more details: https://www.chalmers.se/en/staff/Pages/henrik-leion.aspx</p>
	<p>Prof. Sreenivas Jayanti is a Professor in Department of chemical engineering at IIT Madras, India. His research interests include clean coal technologies, carbon capture and sequestration, fuel cells and redox flow batteries. Prof. Jayanti has about 105 papers published in peer-reviewed SCI indexed journals. He has one patent granted and 5 patents filed. He has guided about 20 Ph.Ds and about 8 are on-going. He has completed several sponsored R&D projects and Consultancy projects. Fore more details: http://www.che.iitm.ac.in/~sjayanti/</p>
	<p>Dr. P. V. Suresh is an Assistant Professor in Department of chemical engineering at NIT Warangal, India. His current research interests include Fuel Cells, Flow batteries, CO₂ capture technologies – Chemical Looping Combustion, Modelling and Simulation and Computational Fluid Dynamics. Fore more details: http://www.nitw.ac.in/faculty/id/16329/</p>
	<p>Dr. V. Ramsagar is an Assistant Professor in Department of chemical engineering at NIT Warangal, India. His research interests include Separation techniques, Chemical process modeling and simulation, Process scheduling and Heat exchanger networks Fore more details: http://www.nitw.ac.in/faculty/id/16465/</p>

Course Coordinators

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