SEMINAR INVITATION

ASCENT: Next Generation Pre-Combustion CO\textsubscript{2} Capture Technologies for the Production of Hydrogen from Natural Gas and Syngas

Presented by

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Date: Thursday, 8 December 2016
Time: 11.00 am – 12.00 pm
Venue: Common Room, Room 407, J01 Chemical Engineering Building, School of Chemical & Biomolecular Engineering

Speaker Details:
Dr Matthew Boot-Handford is an early-stage post-doctoral Research Associate in the Clean Fossil and Bioenergy Research Group of the Department of Chemical Engineering at Imperial College London working under the supervision of Prof Paul Fennell. He is currently working on the EU funder ASCENT project. Matthew obtained his PhD from Imperial College London in February 2016 where he investigated the use of biomass as a fuel for chemical-looping combustion applications. Matthew's ongoing research activities include: pyrolysis and gasification of biomass and waste for syngas and bio-oil production; the development and testing of solid CO\textsubscript{2} and O\textsubscript{2} sorbent materials for high temperature solid looping cycles; and studying the interactions between refractory liquids (tars) produced during the pyrolysis and gasification of biomass with O\textsubscript{2}/CO\textsubscript{2} sorbents and tar cracking catalysts. He currently has 3 publications in a high impact factor journals including as first author on a highly cited and holistic review paper on the status of CCS and is co-author of a book chapter on calcium-looping technology for gasification and reforming.

Seminar Details:
ASCENT (Advanced Solid Cycles with Efficient Novel Technologies) is a four year research project that started in February 2014 and is funded by the EU under the FP7 grant agreement. The project focuses on the development of three related high-temperature solid-looping pre-combustion CO\textsubscript{2} capture processes for the production of H\textsubscript{2} and efficient decarbonised power from natural gas or syn-gas. Capturing CO\textsubscript{2} at elevated temperatures (> 300˚C) provides an opportunity for more efficient heat integration options that are not available when the separation is performed at lower temperatures. The ASCENT technologies are designed such that endothermic and exothermic heat requirements of the reforming, shift and sorbent regeneration reactions are matched in an integrated in-situ approach. The three technologies include: (i) an integrated calcium/copper looping cycle; (ii) a sorbent enhanced reforming (SER) process for the production of H\textsubscript{2} to supply a solid oxide fuel cell (SOFC) with the waste heat used to drive the endothermic sorbent calcination reaction; and (iii) the novel carbonated-shift (CSHIFT) process. This talk will provide a brief introduction to the ASCENT project and ASCENT technologies as well as an update on the current status of development of the CSHIFT process.

Carbonated-Shift or CSHIFT is the term coined as part of ASCENT to describe a high-temperature sorbent enhanced water gas shift (SEWGS) process for combined CO₂ capture and H₂ production from syngas using the highly innovative ENDEX reactor technology currently being developed by Calix Limited. The ENDEX (endothermic-exothermic) reactor concept involves using the heat released during the exothermic sorbent carbonation reaction to provide the heat necessary to drive the endothermic desorption reaction. To date, ENDEX reactor development for pre-combustion CO₂ capture has almost exclusively involved calcium oxide as the CO₂ sorbent. However, engineering challenges and safety considerations as well as sorbent capacity degradation issues associated with the high temperature operation required for calcium looping (650-1000 °C) has provoked interest in the application of alternative CO₂ sorbents that operate at more moderate temperatures (300-800 °C) such as alkali-carbonate promoted mixed metal oxides derived from hydrotalcites, magnesium oxide and promoted aluminas. The ultimate objective of ASCENT is to test promising sorbents at industrially relevant conditions, providing a robust proof-of-principle for the process.