Harmonization of the ASCENT technologies to the worldwide Mission Innovation strategy

Mission Innovation is a worldwide initiative to accelerate the implementation of clean energy, announced during the COP21 in Paris on November 30, 2015. Several challenges were selected, one of those is the implementation of carbon capture, to enable near-zero CO_2 emissions from power plants and carbon intensive industries. A workshop has been held in Houston, Texas on September 25-29, 2017 which aims on early stage breakthrough CCUS technologies. The event was conceived as composed of a number of panels where experts have been invited to discuss the fundamentals of the worldwide research in the field of carbon capture, use and storage within the coming years.

One of the panel focused on sorbents and looping systems, and was attended by Paul Fennell, Tom Hills and Stefano Stendardo - members of the ASCENT consortium. In particular, Fennell gave a presentation showing the current state of the art of Calcium Looping (CaL), and included the processes which are being thoroughly investigated in the ASCENT project. The ASCENT project along with SCARLET project were presented as two EU initiatives on the CaL cycle at different scales, with the former more related to proof of concept scale and the latter on pilot scale. Different research actions have been prioritised during the discussion in the panel by the members of the ASCENT consortium with the other panelists: Hills have highlighted the importance of the implementation of CCUS technologies for the decarbonisation of industry whereas Stendardo has suggested to focus the future efforts in the development of new flexible CCUS processes for the production of decarbonised power.

ASCENT consortium is focusing on the experimental tests of novel processes at the proof of concept scale. The activities are complemented with modeling activities to give insight into the dynamics and performances of the lab-scale reactors. The experimental and modeling activities are related to the CaCu, CSHIFT and SER cycles. With regards to the CaCu cycle, the activities are related to the: (i) modification of the experimental set up to reduce heat losses and to improve the initial temperature profiles, (ii) study of the reduction/calcination stage with methane and mixtures of methane/hydrogen for the subsequent validation of the reactor model and (iii) proof of concept of the whole process.

The SER process has been tested in batch Fluidized Bed reactor for hydrogen production by sorption-enhanced reforming of methane at different fluidization velocities for the new sorbent materials developed. The materials performance was satisfactory for operation in fluidized bed environment and operating conditions have been validated. The experimental activities related to the SER process have been complemented with simulation carried out with a Lagrangian- Eulerian approach. A short movie of the simulated fluidized bed have been posted in the ASCENT website. Experimental long-term multi-cycle runs were performed in a micro-fixed bed reactor set-up to test the chemical stability of the materials. A satisfactory stability in relevant operating conditions has been achieved up to 200 cycles.

As for the CSHIFT, benchmarking of the process clearly showed that the process has a good potential when the process is run in an adiabatic manner with an efficient heat integration between the carbonator and calciner. New, alternative, process CSHIFT concept have been discussed and modeled.

The ASCENT consortium is proud to contribute with the other EU initiatives in paving the future of the worldwide research in the advanced CCUS processes and demonstrating the value of continued EU research, including the contribution of the UK. Assuming that all the Mission Innovation partners remain committed to the initial strategy agreed during the COP21, the contribution of the ASCENT representatives within Mission Innovation are expected to have significant and far-reaching consequences in the long term worldwide research on the decarbonisation of industry and power.

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