Intensification of Syngas Cleaning and Hydrogen Separation

Partners:

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Abstract from the report

The ultimate objective of the Project is to develop integrated biomass based energy and feedstock technologies based on Process Intensification and Miniaturization (PIM) in which gasification has a central technological role while supply of biomass is essential for its sustainability. In gasification, the most important problem is the control of syngas composition; namely, concentration of tars and combustible gases. Although biomass supply was not part of the original aim of the project, materials used in syngas cleaning could also be used as 'synthetic rhizosphere', (SRS) to intensify growth of biomass or crops under water and fertilizer stress. These materials can be used as syngas cleaning media and when their capacity for tar removal is reached, they can then be used as soil additive which then function as SRS. In this Project, we have therefore developed and where appropriate, patented the following technologies:

1. Understanding of tar formation in gasification and the nature of tars formed
2. Primary tar removal within the gasifier, enhancement of syngas calorific value and hydrogen concentration,
3. Development of 3 different equipment for the intensified syngas cleaning and tar, removal - tar degradation which can also be integrated with the gasifier,
4. Re-designing of the gasifier and process conditions to generate low tar, high calorific syngas with in-situ hydrogen generation and removal and carbon dioxide capture,
5. Development of hydrogen-selective membranes for applications in syngas separation,
6. Development of nano-structured micro-porous materials for syngas cleaning, syngasto-energy carrier conversion and soil additive (SRS-media) applications,
7. Syngas cleaning and conversion to liquid fuel through the use of nano-structured microporous materials developed in the project through thermochemical and biochemical routes.

This current project (EP/F038453) is an extension of a previous grant from EPSRC (EP/E010725). Some of the work initiated in EP/E010725 (end date Jan 2009) was completed (to enable the completion of patent applications) in this current project (EP/F038453) and extended further opening new research areas while strengthening the technology base for the establishment of an 'Integrated Intensified Biomass Based Energy and Chemicals Technology'. These new research areas will be further developed and patent position will be strengthened through two new EU projects (COPIDE, start September 2009, 42 months) and POLYCAT, start November 2010, 42 months) with over 25 participants across EU and Europe (Russia and Switzerland). In the mean time, the IPR generated by EP/F038453 and EP/E010725 will be commercialised by a second spin-off company, GAP Technologies Ltd.

Both EP/E010725 and EP/F038453 were small grants (ca. £150k each, lasting 24 months each). The augmentation of these grants is apparent through the number of researchers as well as the principle investigator's own financial contribution.