

One small step...

Carefully combining two innovations brought Oxford Catalysts and Velocys success in the category for Best Innovation by an SME

PRODUCTION OF liquid biofuels such as diesel and jet fuel from organic materials including municipal waste, is an attractive proposition. But using conventional large-scale plants requires bulky waste to be transported, often over long distances, negating some, if not all, of the environmental benefits.

An alternative being developed by UK-based Oxford Catalysts and its US subsidiary Velocys is distributed production based on the use of small-scale, high-intensity plants located close to the source of the waste. Microchannel reactors, combined with highly reactive *Fischer-Tropsch* (*F-T*) catalysts optimized for use in them are central to the distributed production approach.

The plants will work by converting synthesis gas (syngas – a mixture of carbon monoxide and hydrogen produced by gasifying the biomass waste) into the liquid fuels. A wide variety of carbon-containing materials, such as plant biomass-like crop residues and lignocellulose waste from trees, animal-derived waste, and municipal solid waste can be used as feedstocks.

"In contrast to conventional *F-T* biomass-to-liquid (BTL) plants, which are designed to process at least 10,000 tonnes/day of feedstock, the microchannel reactors can operate

economically when handling just 500–2,000 tonnes/day, and achieve productivities that are orders of magnitude greater than for conventional *F-T* reactors," explains Derek Atkinson, business development director at Oxford Catalysts. Depending on the gate fee for the feedstock, the process could be economical at oil prices as low as \$60/bbl.

The *F-T* catalysts arose from pioneering work carried out 15 years ago by Malcolm

oped by Velocys, based in Plain City, Ohio, and acquired by Oxford Catalysts from US nonprofit organization the Battelle Memorial Institute last year. In recent trials, a pilot-scale microchannel *F-T* reactor system was operated successfully for 4,000 hours. The volumetric productivity of the test reactor, defined in terms of kg of product per cubic meter of catalysts per hour, was 10–15 times greater than current *F-T* reactors.



"Microchannel reactors can operate economically when handling just 500–2,000 tonnes/day [of biomass feedstock]"

Derek Atkinson, business development director, Oxford Catalysts

Green at the inorganic chemistry department of the UK's University of Oxford. Oxford Catalysts was spun off in 2004 to commercialize this and other technologies.

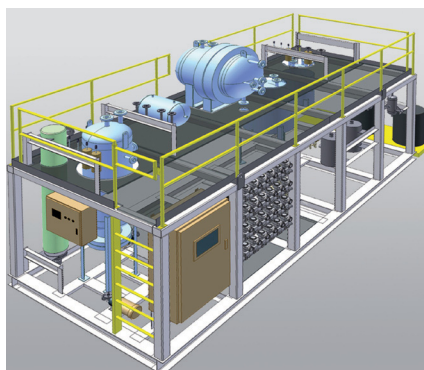
In these catalysts, the crystal size is tightly controlled by means of a patented preparation technique known as organic matrix combustion. This results in a highly active and very stable *F-T* catalyst, which is characterized by stable performance and long life in the reactor before replacement is required.

The microchannel reactors are based on the use of microchannel process technology, a developing field of chemical processing that exploits rapid reaction rates by minimizing heat and mass transport limitations. Microchannel reactors are made up of individual modules, each just 2ft³ (0.6m³) in size and capable of producing 25bbl/day of liquid fuel. In the modules, the key process steps take place in parallel arrays of microchannels, each with diameters in the range 0.1–5mm. Plant size can be increased by adding additional modules, reducing capital and operating costs.

The microchannel reactors were devel-

A number of commercial-scale demonstration units will be commissioned during 2009 and 2010, leading to full commercialization in 2011, he adds. One of the demonstration trials is being carried out in the town of Gussing, Austria – a leader in the use of alternative technologies that is determined to be a true carbon-neutral community. There, a small skid-mounted 26gal/day (100 liter/day) *F-T* unit will be installed alongside a wood chip-fired gasifier that produces heat and power for the town, and a synthetic natural gas facility. The facility is expected to be operational in January.

The microchannel reactors show potential in other areas, too, says Atkinson. They offer a convenient route to hydrogenation of *F-T* waxes to produce the diesel and jet fuel, without the use of high-pressure hydrogen. In addition, they are very useful in situations where either the reactants or intermediates are hazardous and therefore safety concerns are an issue. ■



The microchannel reactors are compact

OXFORD CATALYSTS

» For more information on Oxford Catalysts, go to www.oxfordcatalysts.com