Paraffinic aviation e-fuels by Fischer-Tropsch route

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There is a high demand to reduce emissions of aviation. Direct electrification is not a short or even medium term solution for aviation and therefore, sustainable fuels will be the main solution to reduce emissions of the aviation. Since biofuel resources will not be able to cover the global demand, there is a need for other carbon neutral fuels, in practice e-fuels. The most feasible route to produce e-fuels from carbon dioxide and sustainable hydrogen is to apply Fischer-Tropsch synthesis. However, carbon dioxide has to be first converted to carbon monoxide in reverse water-gas shift reaction (RWGS) since most of the FT catalysts are not active for CO_2 as a raw material. In this two-step process, the efficiency from CO_2 to fuels is limited to 50-60 % mainly due to equilibrium limitations of RWGS step. VTT has developed a process where CO_2 efficiency can be increased to 85-95 % by circulating light hydrocarbons and unreacted gases back to a combined RWGS/catalytic partial oxidation reactor (CPOX) (Figure 1).

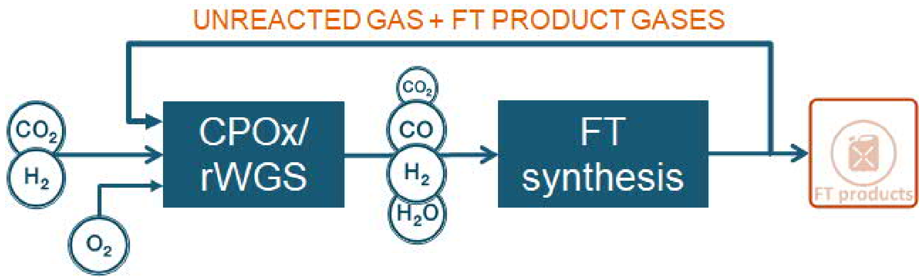

Figure 1. VTT improved process from CO_2 and H_2 to paraffinic fuels.

VTT has already demonstrated the production of jet fuel by the process described in Figure 1 and by upgrading the intermediate, linear paraffinic hydrocarbons, to jet fuel by hydroisomerization/hydrocracking (Figure 2).

Figure 2. JET A-1 sample produced by VTT process.