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Technical Challenge of GTL Technology

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Abstract

JOGMEC and Japanese private companies have been developing GTL technologies since 1998. We successfully developed JAPAN-GTL process using a part of CO₂ in feed gas at 7BPD of pilot plant⁽¹⁾⁽²⁾ and proceeded to next stage which is 500BPD of demonstration plant. This paper introduced the current status of the JAPAN-GTL demonstration test project.

Introduction

The purpose of this research is to develop Gas-to-Liquids fuel technology, JAPAN-GTL, which can be utilized for technological and economic purposes on a commercial scale (at or above 15,000 BPD per train). For this purpose, JOGMEC, Nippon GTL Technology Research Association and 6 private Japanese companies such as INPEX Corporation (Inpex), Nippon Oil Corporation (Nippon Oil), Japan Petroleum Exploration Co.Ltd.(Japex), Cosmo Oil Co. Ltd.(Cosmo), Nippon Steel Engineering Co.Ltd.(Nippon Steel Eng), and Chiyoda Corporation (Chiyoda) have established JAPAN-GTL technology on a demonstrational scale of 500 BPD as a prerequisite to commercial scale production, and is studying scale-up techniques for commercialization purposes.

JAPAN-GTL Process

Figure 1 shows the features of the JAPAN-GTL process. The synthetic gas production process, employing the Steam/CO₂ Reforming method, allows natural gas, containing CO₂, to be used as feed gas. Therefore, the JAPAN-GTL process does not require an oxygen plant and a CO₂ removal process, which are necessary for conventional GTL processes. This makes the JAPAN-GTL process economically advantageous in case of natural gas including 20-30 mol% of CO₂. By utilizing the features mentioned above, the JAPAN-GTL process enables economical development and operation of gas fields where a large quantity of CO₂ exists and is therefore left undeveloped.

The FT synthetic process employs a slurry bed reactor using Co based catalysts. It should be noted that highly active catalysts having the world's highest synthetic oil production performance has been developed at a pilot scale⁽¹⁾.

The upgrading process performs fractional distillation of the raw oil obtained by the FT synthetic process into naphtha, middle distillate, and wax, and performs hydrotreating. For the hydrocracking of wax, catalysts with higher activity levels and selectivity than those of other producers have been developed by optimizing the catalyst carrier. The produced oil is superior in low-temperature fluidity to those produced by conventional processes.

JAPAN-GTL process is aimed at developing utilizing CO₂ in natural gas as a part of feed gas at syngas section, producing FT oil stably at FT section and making clean diesel oil fitting most of diesel regulations in the world.

Results and Discussion

The construction of a demonstration plant was started in 2007. Now we are constructing it based on the research schedule as shown in Table 1. 3 main reactors consisting of the syngas reactor, the FT reactor and the upgrading reactor have already installed as shown in Figure 2. We conducted the construction with keeping a variety of regulations such as "high pressure gas control law" and "industrial safety and health law" of Japanese standards. Up to the present time, there is no critical trouble. This suggests that planning and implementation was performed well.

Along with the construction, the prototype production of industrial catalysts and development of simulators have been conducted.