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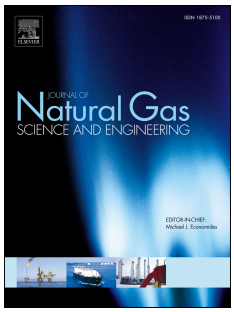

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OXIDATIVE CONVERSION OF WET AND ASSOCIATED GASES TO FUELS FOR POWER PLANTS

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Abstract
The characteristics of gas fuels for power plants produced by the partial oxidation at high pressure or by oxidative cracking at ~750 °C of wet natural gas and associated gas are presented. The introduction of an additional stage of preliminary oxidative conversion (pre-reforming) in a flow reactor at initial oxygen concentrations of 5−8%, pressures of 25−40 bar, and temperatures of 450−600 °C or the oxidative cracking stage at atmospheric pressure and ~750 °C makes it possible to selectively oxidize "heavy" low-octane components of complex hydrocarbon mixtures and to produce fuel gas mixtures for power plants with a high methane number and a required lower heating value. The preferable oxidation agent is atmospheric air rather than oxygen-enriched air or technical oxygen. The introduction of another additional stage of catalytic carbonylation makes it possible to synthesize a number of valuable GTL products, which can compensate expenses to costs of the proposed refinement of wet natural gas and associated gas.

Keywords: natural gas, associated gas, gas fuel for power plants, methane number, low heating value, partial oxidation, oxidative cracking

1. Introduction

Natural gas gains growing positions in the global energy sector due to its obvious advantages, including availability, accessibility, versatility, and smaller impact on the environment as compared with other fossil fuels (Wood et al., 2012). Importance of natural gas in the global energy balance rises constantly, and between 2020 and 2030 it could become a leading fossil fuel (Al-Sobhi and Elkamel, 2015). According to the EIA forecast, in 2010–2040 the fraction of natural gas in the world electricity generation will grow from 22 to 24% (EIA, 2013).

For the centralized energy supply, large power generating plants based on gas-turbines with more than 20 MW power and 33–35% efficiency are used. At present the combined steam-gas-turbine installations with the efficiency close to 60% are employed. However, for local distributed power generation within the power range <10 MW, gas-piston engines (GPEs) are clearly preferential because of their high reliability, considerable economy in electric networks, and, as a result, better fuel saving. Their efficiency exceeds 40% (up to 46–47%). Taking into account heat cogeneration, the efficincy becomes higher than 90%.