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Coal liquefaction by hydrothermal method

Hydrothermal coal liquefaction technology on an installation for direct hydrogenation of coal

Technology description

The technology is based on an innovative approach to the conversion of lignite coals with high water content into liquid hydrocarbon products using Hydrothermal Liquefaction (HTL). The aim of the research was to develop the basics of the HTL process for the production of liquid fuels from domestic lignite resources. An experimental program was carried out for experimental tests in a continuous operation installation at the Clean Coal Technology Centre, GIG.

HTL technology uses the specific properties of water, which at high temperatures and under high pressure, acquires a clear ability to dissolve macromolecular structures of carboniferous materials and stabilize the resulting products.

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Advantages

During the research conducted on lignite from the Turów deposit, the yield of the main liquid product was about 23% of weight, calculated as batch coal in the dry and ashless state (daf). The liquid product was characterized by an average calorific value of about 33 MJ/kg, and in its chemical composition hydrocarbons corresponding to the medium-boiling oil fraction were identified. Due to the relatively high oxygen content, i.e. about 12% of weight, the product needs to be adjusted to the requirements for liquid fuels and needs to be upgraded by hydrotreating (catalytic hydro-deoxidation).
The most important advantages of the technology that uses water as liquefaction agent include its low price, ease of separation of final products and the possibility of processing fuels with high water content. Due to this last feature, domestic brown coals with high humidity may constitute an important raw material base for HTL processes.

Application

Ignite is a significant part of domestic coal resources. However, its specific physicochemical properties impose restrictions on its use. High moisture content (up to 60%), in most Polish brown coals, means that conventional methods of their use (combustion, thermochemical conversion) are characterized by relatively low energy efficiency of the process.
The development and implementation of innovative and effective technologies for the conversion of solid fuels into liquid products, referred to by the general abbreviation CtL (Coal-to-Liquids) is an opportunity to diversify the sources of hydrocarbon fuels in the overall structure of petrochemical products consumption. The methods of their use (combustion, thermochemical conversion) are characterized by relatively low energy efficiency of the process.
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