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MANUFACTURE OF SYNTHESIS-, HYDROGENATING-, OR REDUCTION-GAS

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 No Drawing. Filed Mar. 11, 1968, Ser. No. 711,919
 Claims priority, application Germany, Mar. 11, 1967, H 62,106

Int. Cl. C01b 2/02; C10b 47/00; C10j 3/02
 U.S. Cl. 252-373 2 Claims

ABSTRACT OF THE DISCLOSURE

The invention is concerned with the production of a crude gas from readily available coal which crude gas by simple purification is suitable for the manufacture of synthesis-, hydrogenating-, or reduction-gas used in the chemical, petrochemical and metallurgical industries, the said crude gas being obtained by coking coal at high temperature and coking speed, e.g. more than 1450° C. and 15 mm./hr. respectively.

The constantly increasing requirement for synthesis-, hydrogenating-, and reduction-gas is met by its production from coke, coke-oven gas petroleum or natural gas. The production of synthesis-, hydrogenating-, or reduction-gas from coke or from coke-oven gas is only profitable if the coal used for the production of the above products is available at favourable cost. This is however not assured in most cases.

Furthermore, coke-oven gas and also the carbon-rich materials produced in the usual coking process are replaced by oil gas and natural gas charges of the ever-growing displacement process and a profitability-favourable charge of coke-oven gas for the production of the above-noted products is no longer presented.

It may also be mentioned that, for example, the amounts of cracked carbonaceous materials occurring in the splitting of oil gas or natural gas present certain difficulties and require special expenditure for avoidance or elimination.

The invention is accordingly directed to the problem of creating a process for obtaining synthesis-, hydrogenating-, or reduction-gas, in which readily available coal is used as starting material and in which neither carbon is difficultly usable form nor the increasingly more difficultly disposable or workable coke-oven gas is produced.

According to the invention there is provided a process for the manufacture of synthesis-, hydrogenating-, or reduction-gas, characterised in that coal is coked in a chamber at such high temperature and/or coking speed that the crude gas has the desired composition for further treatment to synthesis-, hydrogenating-, or reduction-gas by purification and has a low content of carbon-rich material.

The invention is based on the discovery that through an increase of the coking temperature and/or coking speed lying fully within the framework of technical possibilities, the carbon-rich materials contained in the coke-oven gas are already cracked in the chamber to a much predominating proportion, so that the carbon produced from the carbon-rich materials remains in the chamber together with the coke and can be used with this. The proportion of the hydrocarbons or carbon-rich materials respectively remaining in the coke-oven gas can by the selection of the coking temperature and/or the coking speed be limited to that amount in which an economical treatment of the crude gas to the synthesis-, hydrogenating-, or reduction-gas, by purification is possible.

It is particularly advantageous to select the free gas-collecting space above the coke charge in the chamber relatively large so that it amounts to at least 10% of the chamber volume. It is additionally of advantage to adapt the temperature of the gas-collecting space to the coking temperature. In this way the cracking of the hydrocarbons is favourably influenced to a substantial degree. In carrying out the process according to the invention the coking temperature and/or the coking speed are preferably more than 1450° C. and 15 mm./h. respectively.

The further treatment of the crude gas to synthesis-, hydrogenating-, or reduction-gas can be effected by cooling the crude gas in known manner, whereby a rich gas fraction containing hydrocarbons still present in it is separated from the crude gas. This rich gas fraction contains as impurity hydrogen sulphide in relatively high concentration, so that the separation of this impurity from the rich gas fraction in a known manner can be carried out under economically very favourable conditions. The purified rich gas fraction can then be used for heating the chamber or for chemical purposes.

Whilst in the customary coking method with a coking temperature of about 1300° C. and coking period of about 19 hours, a coking speed of about 12 mm./h., a coke oven gas is obtained which contains about 55% hydrogen, 27% methane, 5 to 6% carbon monoxide, and about 5% nitrogen as well as carbon dioxide and heavy hydrocarbons, namely between 2.5 to 4.5% tar, 0.6 to 1.5% benzene as well as 0.2 to 0.3% ammonia and 0.3 to 0.7% hydrogen sulphide, there results in the process according to the invention with a coking temperature of about 1550° C., a coking time of about 10 hours and a coking speed of about 22 mm./h., a crude gas which contains about 70 to 80% hydrogen, 7 to 15% of carbon monoxide, small amounts of nitrogen, carbon dioxide and methane as well as about 0.2% tar, 0.1% benzene, 0 to 0.2% ammonia and about 0.5 to 1% of hydrogen sulphide.

The further treatment of the crude gas takes place in known manner, for example by supercooling. Herein hydrogenating hydrogen or a synthesis gas fraction is obtained, which contains essentially hydrogen and carbon monoxide as well as nitrogen and is free from hydrocarbons. The separated rich gas fraction contains essentially methane, carbon dioxide, heavy hydrocarbons and hydrogen sulphide. Although the hydrogen sulphide portion of the crude gas obtained in the process according to the invention is higher than in conventional coke-oven gas, its removal according to known processes from the rich gas fraction presents no difficulties, since the hydrogen sulphide is present there in relatively high concentration. The high hydrogen sulphide content of the crude gas is attributable to an extensive desulphurisation of the coke, which favours its use for metallurgical purposes. The coke is obtained in relatively small pieces and in this form is particularly well adapted for use in a blast furnace. It is furthermore noteworthy that the ammonia is produced, if at all, only in very small amounts, which is particularly advantageous since this product only rarely can be obtained and utilised under economically tolerable conditions.

I claim:

1. Process for the production of a gas having a relatively high content of hydrogen and a relatively low content of hydrocarbon, which comprises coking coal in a chamber, without the admission of gases into the chamber, at a coking temperature between about 1450° C. and about 1550° C., and a coking speed between about 15 and about 22 mm./hour to provide a crude gas having a low content of carbon rich material and then purifying said crude gas by removing at least hydrocarbons, carbon dioxide and hydrogen sulfide.

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2. Process for the production of a gas having a relatively high content of hydrogen and a relatively low content of hydrocarbon, which comprises coking coal in a chamber, without the admission of gases into the chamber, at a coking temperature of at least about 1450° C. and a coking speed of at least about 15 mm./hour, to provide a crude gas having a low content of carbon rich material.

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U.S. Cl. X.R.

23—212; 48—210; 201—41