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On possibility of air and steam plasmas applications for gasification of organic containing substances and synthetic liquid fuel production from methane

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Some results of gasification of some substances by means of air and steam plasmas are presented. Results of experiments and their comparison with calculation are given. The possibility of synthesis gas production by means of steam plasma with optimum relationship H2/CO ~ 2.1 for liquid fuels production is discussed.

Methane has the highest thermostability among other hydrocarbons of the associated petroleum gas. That is why the methane decomposition is considered while developing methods of conversion of associated petroleum gas to synthesis gas.

Plasma used as an oxidizing agent allows elimination of catalysts from the process of synthesis gas production due to achievement of high temperatures ~1400°C at atmospheric pressure. The reaction rates in a gas phase is sufficient for conversion of associated petroleum gas to synthesis gas during ~1 s. It is necessary to generate plasma with heat content of ~15 MJ/kg that matches to temperature ~3060°C. There is a considerable dissociation of steam and carbon dioxide with formation of more active molecules and radicals.

The plasma method allows production of ~5.4 m^3 of synthesis gas from 1 kg of methane (~1.4 m^3) as it is resulted from numerical evaluation. Also estimates show that ~23.9 MJ (6.6 kWh) of electricity is necessary to process 1 kg of methane.

The experimental results of 100 kW AC plasma torch operation using as a working media a mixture of $CH_4 + H_2O + CO_2$ in required ratio are presented. Efficiency of synthesis gas production of desired composition is evaluated.

Biography

Irina Kumkova, Ph.D., graduated from Leningrad State University. Leading Scientist of IEE RAS. She has published about 120 papers in reputed journals. The major interests are concentrated in physics of dense low temperature plasma, discharges in gas flows, plasma technologies for waste treatment of different types, renewable energy generation and synthetic liquid fuels production.

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