EXPERIMENTAL STUDY OF OXIDATIVE CRACKING OF ETHANE–ETHYLENE MIXTURES AT PRESSURES OF 1 TO 3 ATM

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Abstract: The important task of gas chemistry is processing of refinery gases of composition which can vary significantly at various oil refineries. The work is devoted to the development of scientific foundations for a new method of refinery gas processing, the first stage of which is the oxidative cracking of C_2^+ hydrocarbons that are the part of refinery gases into valuable products with a high added value. Experimental studies of oxidative cracking of ethane and its mixtures with ethylene were carried out in a flowing quartz reactor. Experiments were made at pressures of 1 to 3 atm, temperatures from 500 to 750 °C, reaction time of 2 s, and initial C/O ratio in the range of 2.3 to 2.5 ($\alpha = 0.115$–0.124) using mixtures diluted with nitrogen. Differences in the reactivity of ethane and ethylene at the oxidative stages of the process for these conditions are identified.

Keywords: refinery gases; oxidative cracking; ethane, ethylene

DOI: 10.30826/CE22150104

Figure Captions

Figure 1 Schematic of the laboratory installation: *1* — gas cylinders; *2* — gas reducer; *3* — gas flow regulators on thermal conductivity; *4* — digital display system of control and power of gas flow regulators; *5* — electric heater; *6* — tri-zone thermocouple of type K; *7* — thermocouple of type K; *8* — PID temperature controller; *9* — separator; *10* — water refrigerator; *11* — gas flow meter; *12* — valve; *13* — dehumidifier; and *14* — quartz reactor

Figure 2 Temperature dependence of reagent conversion during oxidative cracking of ethane and ethylene: *1* — C_2H_6; *2* — O_2 (oxidative cracking of ethane); *3* — C_2H_4; and *4* — O_2 (oxidative cracking of ethylene)

Figure 3 Temperature dependence of product concentrations of ethylene oxidative cracking at $P = 1$ атм: *1* — CO; *2* — CO_2, *3* — CH_4; and *4* — H_2

Figure 4 Temperature dependence of product concentrations of oxidative cracking of a mixture of ethane and ethylene (56 %(mol.) C_2H_6 + 44 %(mol.) C_2H_4) at $P = 1$ (*a*) and 3 atm (*b*): *1* — C_2H_4; *2* — CO; *3* — CO_2; *4* — CH_4; and *5* — H_2

Figure 5 Temperature dependence of ethane conversion during oxidative cracking of a mixture of ethane and ethylene (56 %(mol.) C_2H_6 + 44 %(mol.) C_2H_4): *1* — 1 atm; *2* — 2; and *3* — 3 atm

Acknowledgments

The research was supported by the Russian Foundation for Basic Research and by the Committee on Science of the Republic of Armenia in the frame of the scientific project No. 20-53-05001.

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Received December 24, 2021

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