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Study of the influence of ultrasonic radiation on aqueous solutions of methane, ethylene and their mixtures

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One of the methods of influencing chemical reactions is the use of ultrasound. In this case, most chemical reactions in ultrasonic fields occur in aqueous solutions in the presence of cavitation. It is known that under the influence of cavitation, the direction and speed of chemical reactions occurring in a solution can change significantly. In a number of cases, processes may occur that are not feasible under normal conditions.
Wide opportunities may open up when hydrocarbon oxidation processes are carried out under such extraordinary conditions (temperatures up to 20.000℃; pressures of several thousand bar, and heating and cooling rates of>1000℃ s−1).
The aim of this work is to study the kinetic regularities of oxidative conversion of methane, ethylene and their mixtures under the influence of ultrasound on their aqueous solutions in the absence and presence of oxygen.
The transformation of methane, ethylene and their mixtures in aqueous solutions under the influence of ultrasonic radiation with a frequency of 22 and 44 kHz under cavitation conditions was studied. It was found that formaldehyde, which is the main product, is formed even if there is no dissolved oxygen in the initial solution. This fact proves that under the influence of cavitation, methane and ethylene can directly interact with water.
It was shown that the rate of accumulation of formaldehyde depends on the power of the supplied ultrasonic radiation, radiation frequency and the amount of molecular oxygen introduced into the system.
Based on quantum chemical calculations a possible scheme for the formation of formaldehyde is proposed.

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