Processes of carbon disulphide conversion in pulsed corona discharge plasma

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Carbon disulphide CS$_2$ is a toxic component of exhaust gases from cellophane and viscose production. As an alternative to conventional technologies, electrophysical methods of CS$_2$ conversion are developed, for example, the use of DC corona discharge [1], pulsed electron beam and non-self-sustained discharge [2].

In this report results of investigation of CS$_2$ conversion in pulsed corona discharge plasma are presented. We used the installation [3] with the following parameters: high voltage amplitude 150-170 kV, corona discharge current amplitude 100-300 A, pulse duration 15-30 ns, pulse repetition rate 1-10 Hz. Air mixture containing 50-10000 ppm CS$_2$ was processed. A method of gas chromatography was used to determine a quantitative composition of mixture before and after processing.

It was determined that main products of CS$_2$ conversion are SO$_2$, COS and CO$_2$. When CS$_2$ was almost totally converted, further processing led to decomposition of SO$_2$ and COS with a formation of H$_2$SO$_4$ and CO$_2$. CS$_2$ concentration decreased from 10000 ppm to 650 ppm after 30000 corona shots with energy expenditures to remove one CS$_2$ molecule 8 eV/molecule. In this case energy efficiency of CS$_2$ removal is 360 g·kWh$^{-1}$. With initial 3000 ppm CS$_2$ its concentration decreases to 50 ppm after 12000 shots with energy expenditures 11 eV/molecule and energy efficiency 260 g·kWh$^{-1}$. The obtained energy efficiency of CS$_2$ conversion is worse than with the use of pulsed electron beam [2] but better than with the use of DC corona discharge [1]. In our opinion plasma-chemical mechanism of CS$_2$ conversion in pulsed corona discharge plasma is the same as in electron-beam plasma.

Thus, the use of pulsed corona discharge is a new effective method of CS$_2$ conversion in air. The advantages of this method in comparison with electron-beam one are less complexity, lower costs, higher reliability and safeness.

References