COMPUTER MODELLING IN AIR POLLUTION CONTROL

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The most important source of air pollution is the combustion of fossil fuels and pollutants emitted in these processes are SO_2, NO_x, volatile organic compounds (VOC) and others. Different technologies have been applied for air pollution control e.g. coal and oil desulfurization, combustion modification or flue gas purification. Electron beam flue gas treatment technology is among the most promising advanced technologies of new generation. The research on it have been carried on in the Institute of Nuclear Chemistry and Technology for many years.

The electron beam flue gas purification is based on the excitation of the gaseous molecules by the high energy electrons and formation of ions, free radicals and other active species. This species react with the pollutants such as SO_2, NO_x and VOC leading to their transformation and removal. The removal efficiency depends on many factors such as temperature, humidity, absorbed dose and initial concentrations of chemical compounds. In order to understand the mechanism of the process the mathematical model has been made. The results of model calculations show a good agreement with the experimental data.

Dose distribution in the irradiation vessel is also one of the crucial problems of the electron beam flue gas treatment technology. It is not uniform due to absorption of electron energy in the gas phase. This phenomenon influences the overall NO_x removal efficiency to a high degree. The problem of optimal location of accelerators and multistage gas irradiation system was analysed using the computer model of the reactor.

The computer simulations have been performed to evaluate the energy deposition in the gas phase under influence of electron beam. The obtained data has been applied to design the reaction chamber devoted to SO_2 and NO_x removal initiated by ionizing radiation. The comparison of calculated and experimental data regarding the spatial dose distribution shows a good agreement what allows to predict with good accuracy the energy deposition in pollutants removal process.

The computer simulation results as well as pilot plant experiments allowed to design the full industrial scale installation for simultaneous SO_2 and NO_x removal, that has been built and is under testing now.