Modeling of the formation of ultrafine particles as coals burning

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The presence of highly dispersed particles in the atmosphere is ecologically hazardous. One of the sources of the aforementioned type of atmospheric pollution is the emission of submicron particles upon combustion of coals. The bulk condensation of vapors of substances produced from the mineral moiety of coals during combustion is a probable formation mechanism of submicron particles in this case. For efficient trapping of the above-mentioned particles, it is necessary to know the parameters of condensation aerosols that result from combustion, such as their number concentration and size distribution, which can be used for numerical simulation of the bulk condensation process. As applied to the combustion products of coals, which are multicomponent reactive systems, it is reasonable to use a comprehensive thermodynamic and kinetic approach. Thermodynamic analysis of the composition of combustion products have been performed for 15 types of coals with and without allowance for potassium and sodium aluminosilicates. Based on the results obtained, a closed model has been proposed for the formation of submicron particles in the combustion products of the coals. The bulk condensation of potassium sulfate vapor in the flow of the combustion products and upon their cooling along a technological path has been numerically simulated by means of computer assisted realization of the proposed model. The concentration and size distribution of the formed particles have been determined. The calculated and experimental data on the fractional composition of the particles are compared. Agreement with experimental data has been reached at a reasonable value of a free parameter of the model.