Translated from *Uspekhi Khimii* **60** 633 (1991)

Development of new ecologically clean technologies in the manufacture of nitric and sulphuric acids

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Studies on ecologically clean manufacturing processes are being developed in several directions in the Laboratory of Macrokinetics of the Division of the Institute of Chemical Physics of the USSR Academy of Sciences. The first concerns the creation of new technologies in the manufacture of sulphuric acid. Using a special reactor and a stoichiometric mixture of sulphur dioxide, oxygen, and water vapour as the reaction mixture, it has been possible to organise the process in such a way that the sulphur dioxide [trioxide?] formed in the reaction combines with water and condenses on the cold walls of the reactor. As a result, it is removed from the reaction, leads to no aftereffect, and does not inhibit the reaction. The advantages of this method are evident. Firstly, it has been possible to raise the concentration of sulphur trioxide from 10 to 66% and to reduce significantly the dimensions of all the gas connecting tubes. Furthermore, such a technology makes it possible to organise a closed cycle and hence to go over a completely waste-free manufacturing process.

Yet another way of obtaining sulphuric acid is undergoing laboratory tests at the present time and consists of the following steps: if a stoichiometric SO_2+O_2 mixture is frozen until solid, is irradiated with a light flux, and is then rapidly warmed, a reaction takes place at a high rate and with a high yield as a result. This procedure for the synthesis of H_2SO_4 has been tried in several laboratories.

Finally, yet another aspect of such investigations is associated with the safety of the operation of chemical reactors and of power engineering.

During the last decade, we have been actively concerned with the study of ebullition, which is a field seemingly very remote from chemistry. However, it was found that ebullition crises are surprisingly analogous to processes such as combustion and detonation, i.e. the traditional objects of study at the Institute of Chemical Physics.

The latest results achieved in this field suggest that in the immediate future we shall apparently be able to describe and understand the physics of the dangerous phenomenon of the vapour-phase explosion.