RESEARCH ON THE UTILIZATION AND IMMOBILIZATION OF LIQUID RADIOACTIVE WASTE IN AIR PLASMA

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The idea of the developed closed nuclear fuel cycle allows for the development of solid products fit for long-term storage in addition to the disposal of all varieties of RW. The unique quality of RW is that their relative decontamination can only be accomplished by storing them for an extended period of time to allow the radionuclides within to decay [1].

The current technology for disposing of SNF processing waste (SNF PW) involves a lengthy, energy-intensive process that does not allow for the possibility of future use. It takes the form of water solutions with a low content of actinides, non-radio-

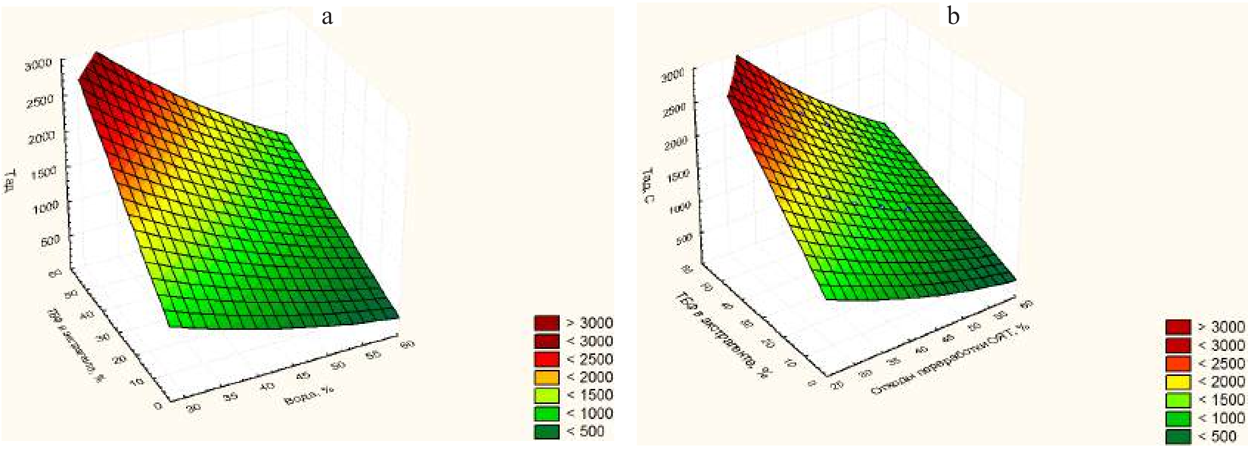

Fig. 1. *Calculation of water-salt-organic matter combustibility indicators compositions made from waste from the spent nuclear fuel processing*

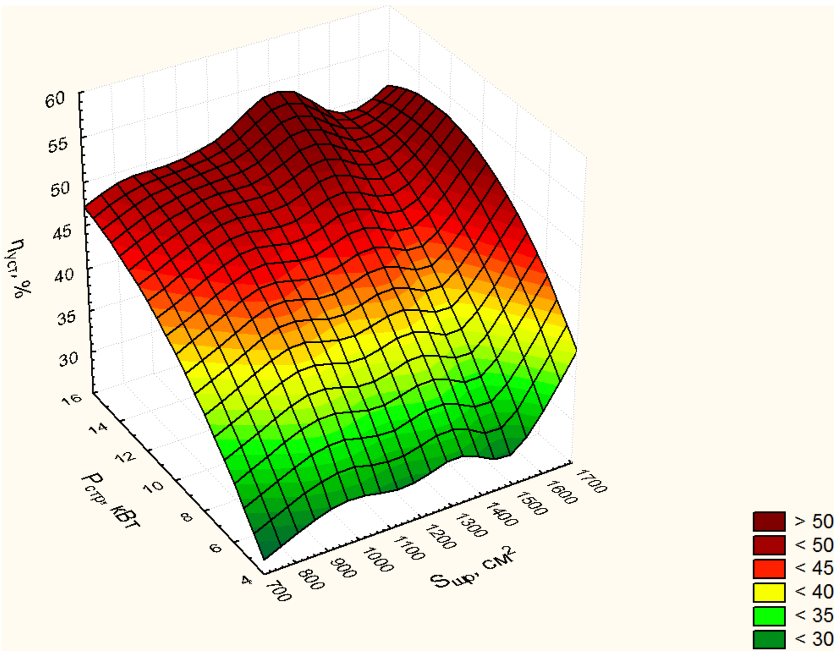

Fig. 2. *Influence of the power of the VHF discharge and the input area of the reactor impeller on the installation efficiency of the plasma module based on high-frequency generator VChG8-60/13-01*

active decay products (Mo, REE, etc.), and structural materials left over after the first extraction cycle [2].

Gas-discharge plasma offers a single-stage, high-speed method of obtaining oxide compounds from SNF PW's distributed water solutions. Nevertheless, the only processing of water solutions in plasma necessitates high energy consumption (up to 4 kW•h/kg) and does not offer the chemical synthesis of oxide compounds in air plasma with the necessary composition without further hydrogen reduction [1].

Following the extraction cycle, reprocessing of spent nuclear fuel results in reprocessing waste (RW SNF), which is an aqueous nitrate solution (raffinate) with the following composition: [1]: HNO_3, 0.07 percent Fe, 0.11 percent Nd, 0.10 percent Mo, 0.06 percent Y, 0.058 % Zr, 0.04 percent Na, 0.039 percent Ce, 0.036 % Cs, 0.031 % Co, 0.026 % Sr, and remaining H_2O comprise 18,00 % [2].

Figure 1 illustrates the impact on Tad for aqueous organic nitrate solutions based on ethanol (a) and acetone (b) of spent nuclear fuel content (RW SNF) and organic compounds from reactor waste.

Optimization of system operation modes "HF generator-VHF plasma torch" are shown in Fig. 2.

References

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IMPROVING THE ENERGY EFFICIENCY OF THE NATURAL GAS LIQUEFACTION PROCESS IN ARCTIC CONDITIONS

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The process of liquefying natural gas is an economically and energetically costly process, due to the use of heat exchangers of elaborate designs and heavy loads on refrigerant compressors. For upside projects in the Arctic belt, a critical task is to choose the most energy-efficient solution for conducting the natural gas liquefaction process in order to minimize economic costs. This problem is a complex and multifactorial task requiring a comprehensive solution, which can be obtained using pinch analysis and selection of optimal process parameters, taking into account the thermodynamic features of the process.

As part of the work for large-scale production in Arctic conditions, technologies were chosen for research that allow integrating climatic conditions into the process of liquefaction of natural gas. Energy efficiency analysis was carried out for the C3MR (mixed refrigerant technology with pre-propane cooling) and DMR (dual mixed refrigerant technology) processes. These technologies use plate-ribbed and spiral heat exchangers with a large heat exchange surface area and high-power compressors for compressing refrigerant vapor [1].

For the study, industrial data on the composition of the prepared natural gas supplied for liquefaction and the productivity of the processing line were obtained. After analyzing the composition and properties of natural gas from an upside field, thermobaric conditions were determined, taking into account the behavior of the phase state and the quantity of heat with a decrease in temperature, according to which technological modeling of the selected processes in the Hysys software was carried out. Figure 1 shows a model of the DMR process.

To carry out the pinch analysis, a numerical image of the heat exchange system of the studied liquefaction processes was compiled, according to