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The Thermal Decomposition of CH3131I in a Gas Phase

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The localization of volatile radioactive iodine compounds by various sorbents from vapor-gas media is a vital issue for environmental protection during both irradiated nuclear fuel reprocessing and accidents at nuclear power enterprises, including nuclear power plants (NPPs).

The thermal decomposition of methyl iodide CH3131I, a volatile radioactive iodine organic compound, in a gas flow in the presence of various modifications of "Fizkhmin"TM granulated materials based on silica gel impregnated with d-elements were studied.

Test facility included the following basic parts: rotameters; a CH3131I generator; scrubber with water; the heating furnace of mine type; composite materials under study; the thermocouple; a column with SiO2-Cuo; scrubber with 0.05 M Na2SO3 solution; the heating furnace of tubular type; columns with SiO2-AgNO3.

It was found that in the absence of "Fizkhmin"TM material, the degree of the decomposition of CH3131I (10 mg) in air (flow rate 4.5–5.5 cm/s and time of the air flow presence in the heating zone 1.0 –1.5 s) was equal to ≈(7-10)% at (540 ≈ 10)oC, ~(70-75)% at (640 ≈ 10)oC, and ~(97-99)% at (770 ≈ 15)oC.

In the presence of silica gel granules measuring 1.0-3.0 mm, the degree of the decomposition of CH3131I (10 mg) in air (linear flow rate 4.8–5.2 cm/s and time of the air flow presence in the heating zone 1.0–1.1 s) was equal to ≈(2-3)% at (240 ≈ 10)oC, ~(10-15)% at (340 ≈ 10)oC, ~(75-80)% at (440 ≈ 10)oC, and ~(97-99)% at ~(540 ≈ 10)oC. Silica gel granules allow decreasing the CH3131I thermal decomposition temperature in an air flow by ~200oC.

In the presence of "Fizkhmin"TM granulated materials impregnated with Ni compounds or Ni-Cu mixture (8-10 wt.% and granule size 1.0–3.0 mm), the degree of the decomposition of CH3131I (10 mg) in air (linear flow rate 4.8–5.2 cm/s and time of the air flow presence in the heating zone 0.8–1.1 s) was equal to <0.2% at (20 ≈ 3)oC, ~(0.3-1.0)% at (150 ≈ 20)oC, ≈(15-30)% at (250 ≈ 10)oC, ~(85-92)% at (340 ≈ 15)oC, and ~(95-99)% at (465 ≈ 20)oC. "Fizkhmin"TM granules containing 8-10 wt.% Ni or its mixture with Cu, allow decreasing the CH3131I thermal decomposition temperature in an air flow by more than ~300oC.

The dependence of the CH3131I thermal decomposition degree on the concentration of a d-element in the "Fizkhmin"TM material and its storage time, as well as on the amount of CH3131I in an air flow were studied.

In conclusion, it is necessary to note, that the using of granulated composite material "Fizkhmin"TM allow to convert the more difficult localize organic form of radioactive iodine to well-localized molecular form of radioactive iodine.

Primary author: Prof. KULYKHIN, Sergey (Frumkin' Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russia)

Co-authors: Dr RUMER, Igor' (Frumkin' Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russia); Dr MIZINA, Lubov' (Frumkin' Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russia)

Presenter: Prof. KULYKHIN, Sergey (Frumkin' Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russia)

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