Variation of Surface Characteristics and Sorption Properties of Zirconium Silicate Under Irradiation by Bremsstrahlung Gamma Rays

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The effect of Bremsstrahlung gamma rays on the surface parameters of microporous amorphous zirconium silicate and on its ability for sorption is studied. The samples were irradiated using a betatron (electron accelerator) with the maximal energy of the γ-quanta of 10 MeV and 22 MeV. The surface characteristics of the sorbents were studied by low-temperature adsorption/desorption of nitrogen. The experimental data were processed by BET, DR, and BJH methods. The results show that under exposure to Bremsstrahlung gamma rays the micropores of the sorbent under investigation are partly transformed in mesopores.

The ability of zirconium silicate to absorb Sr^{2+} ions from an aqueous solution of strontium chloride is shown to increase noticeably after irradiation by 22-MeV Bremsstrahlung gamma rays. Since some of the zirconium isotopes ($^{40}_{88}Zr$, $^{40}_{89}Zr$, and $^{40}_{90}Zr$) have low gamma ray activation thresholds (5.61 MeV, 11 MeV, and 2.32 MeV, respectively), it is supposed that a certain role in the increased Sr^{2+} ion sorption is played by Zr ion activation which can lead to the formation of vacancies in the sorbent matrix. A similar effect is also observed for another zirconium-containing inorganic sorbent – hydrated zirconium dioxide – and is considerably reduced at the decrease of the gamma radiation energy down to 10 MeV.