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## Synthesis and spark plasma sintering of solid-state matrices based on calcium silicate for Co- 60 immobilization

**Автор:** Shichalin, O. O. (Shichalin, O. O.) ; Yarusova, S. B. (Yarusova, S. B.) ; Ivanets, A. I. (Ivanets, A. I.) ; Papynov, E. K. (Papynov, E. K.) ; Belov, A. A. (Belov, A. A.) ; Azon, S. A. (Azon, S. A.) ; Buravlev, I. Yu (Buravlev, I. Yu) ; Panasenko, A. E. (Panasenko, A. E.) ; Zadorozhny, P. A. (Zadorozhny, P. A.) ; Mayorov, V. Yu (Mayorov, V. Yu) ; [...Больше](#)

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### Аннотация

An effective sorption material for the immobilization of cobalt radionuclides into highly safe and reliable solid-state matrices is proposed. The resulting silicate sorbent  $\text{CaSiO}_3$  had an amorphous mesoporous structure (ABET 53  $\text{m}^2/\text{g}$ ) and a sorption capacity Co ions of 3.32  $\text{mmol/g}$ . The physico-chemical characteristics of the  $\text{CaCoSi}_2\text{O}_6$  sample obtained after  $\text{Co}^{2+}$  ions sorption were studied using XRD,  $\text{N}_2$  and Ar adsorption-desorption, SEM-EDX and TG/DTA methods. Solid-state silicate matrices characterized by high density values (2.86-3.16  $\text{g/cm}^3$ ), compressive strength (150-637 MPa) and Vickers microhardness (1.80-5.25 GPa) were obtained by spark plasma sintering (SPS). The sample obtained at 1000 degrees C had the lowest values of  $\text{Co}^{2+}$  ions leaching ( $R_{\text{Co}} \sim 10^{-7} \text{ g}/(\text{cm}^2 \times \text{day})$ ) and diffusion coefficient ( $D_e 1.73 \times 10^{-17} \text{ cm}^2/\text{s}$ ) from silicate matrices. Thus, the obtained  $\text{CaCoSi}_2\text{O}_6$  silicate matrices saturated with Co ions comply with the regulatory requirements of GOST R 50926-96 and ANSI/ANS 16.1 for  $^{60}\text{Co}$  immobilization. (c) 2022 Elsevier B.V. All rights reserved.

### Ключевые слова

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**Адреса:**

1 Far Eastern Fed Univ, 10 Ajax Bay, Russky Isl, Vladivostok 690922, Russia

2 Russian Acad Sci, Inst Chem, Far Eastern Branch, 159, Prosp 100 letiya, Vladivostoka 690022, Russia

3 Vladivostok State Univ Econ Serv, Gogolya st 41, Vladivostok 690014, Russia

4 Natl Acad Sci Belarus, Inst Gen & Inorgan Chem, Surganova st 9-1, Minsk 220072, BELARUS

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