Nanocomposites and nanomaterials

Adsorption of U(IV) by mono- and bifunctional mesoporous silica with phosphonic and carboxylic groups

V.V. Sliesarenko[1], V.V. Milyutin[2], E.K. Papynov[3,4], V.A. Avramenko[3,4], O.A. Dudarko[1], Yu.L. Zub[1]

[1] *Chuiko Institute of Surface Chemistry, NASU*
17 Generala Naumova St., 03164, Kyiv, Ukraine.
E-mail: sliesarenko@isc.gov.ua

[2] *Frumkin Institute of Physical Chemistry and Electrochemistry, RAS,*
31 Leninskii pr., 119991, Moscow, Russia.

[3] *Institute of Chemistry, Far East Branch of RAS,*
159 prosp. 100-letiya Vladivostoka, 690022, Vladivostok, Russia.

[4] *Far Eastern Federal University, 8 Suhanova St., 690950 Vladivostok, Russia.*

Mono- and bifunctional mesoporous silica with phosphonic (-$PO(OH)_2$) and carboxylic (-COOH) groups in the surface layer were synthesized via one-pot template method. The samples are characterized by well-developed surface (above 500 m^2/g), and the concentration of functional groups about 1-2 mmol/g.

The new approach to the synthesis of phosphorus-containing silica increased the U(IV) sorption capacity (by 1.5 times) and distribution factor (in order of magnitude) compared to samples described in [1], with respective values of 260 mg/g and $3{,}3*10^4$ cm^3/g (at pH 2).

Simultaneous binding of carboxylic and phosphonic groups does not deteriorate the ordered structure of the synthesized materials, but the values of distribution factor and sorption capacity decrease compared with mono-functional samples, which may be due to the adverse reaction of carboxylic groups with the template (Pluronic P123).

The obtained samples were analyzed by a number of physical and chemical methods (nitrogen adsorption, X-ray, IR and NMR spectroscopy, TEM, SEM).

Authors are grateful to the Russian Foundation for Basic Research (project 13-03-90918 mol_in_nr) and the Scientific Foundation of Far East Federal University (project 13-06-006-M_A).

1. *V.V. Milyutin, V.M. Gelis, N.A. Nekrasova et al*. Sorption of Actinide Ions onto Mesoporous Phosphorus-Containing Silicas // Radiochemistry.–2014.–**56.**–P. 262–266.