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P37

Highly efficient macroporous silica/iron oxide based adsorbent for arsenic removal

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Synthesis of macroporous silica based adsorbent impregnated with hydrous iron oxide (goethite -GT) applicable for efficient arsenic removal is presented in this work. The synthesis procedure was conducted in two successive steps: first step includes introduction of amino active sites by silica surface modification with (3-aminopropyl)trimethoxysilane, while the second step includes precipitation of GT on the surface of the modified silica (SiO_2/GT). The effectiveness of introduction of amino groups on silica surface, as well as structures of synthesized adsorbent were confirmed by FTIR analysis. The crystal structure of GT was determined by X-ray diffraction (XRD). The results of textural parameters and surface properties (specific surface area and adsorbent porosity), determined by Brunauer–Emmett–Teller analysis, indicate higher surface area and moderate pore diameter for the adsorbent with GT, comparing to amino modified silica. Morphology parameters, such as shape and adsorbent particle size, were examined by scanning electron microscopy (SEM). The SiO_2/GT adsorbent has spherical shape with the mean diameter of 1–2 mm and highly porous surface. High arsenic removal capacity of 35.9 mg g^{-1} at 25 °C and optimal pH values of 6.6-7.4 indicates that this adsorbent is efficient and reusable for arsenic removal from natural water in the batch mode.

P38

The Bridgman method growth, spectroscopic characterization and photoluminescence of calcium fluoride single crystals

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Calcium fluoride - CaF_2 single crystals were grown using the Bridgman technique. By optimizing growth conditions, <111>-oriented CaF_2, crystals up to 20 mm in diameter were grown. Number of dislocations in CaF_2 crystals was 5×10^4 - 2×10^5 per cm^2. Selected CaF_2 single crystals is cut into several tile diamond saw. The plates were polished, first with the silicon carbide, then the paraffin oil, and finally with a diamond paste. The obtained crystals were studied by X-ray diffraction, Raman spectroscopy, far-IR reflectivity and by the measurement of trans-

mission in the mid IR-range. The crystal structure is confirmed by XRD. One Raman and two IR optical modes predicted by group theory are observed. In the transmission spectra, except modes originated from vibration of -CH_2 groups, hydroxyl groups -OH and KBr, is visible a peak at 671 cm^{-1} assigned to the Ca-F stretching vibrations. A low photoluminescence testifies that the concentration of oxygen defects within the host of CaF_2 is small. All performed investigations show that the obtained CaF_2 single crystal has good optical quality.

P39

Long-term monitoring of photocatalytic coating functional properties inreal environmental conditions

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The work studies functional properties of a photocatalytic coating (TiO_2/Zn-Al) applied on the experimental wall inreal environmental conditions. It is possible to find several methods for photocatalytic activity assessment in laboratory conditions, but the methods for *insitu* measurements of photocatalytic activity can hardly be found in any publication.
Our study was conducted by using modern surface analysis (FTIR spectroscopy, DRIFT mode and traditional microbiological techniques, in order to understand fungal colonization on the façades covered with a photocatalytic coating (previously developed and proved in laboratory as a good antifungal material). For this purpose, an experimental wall was build and covered with a commercial façade paint and (TiO2/Zn-Al) photocatalytic coating. In order to induce fungal growth, the autochthonous microorganisms (*Aspergillus niger* and *Cladosporium*sp. were isolated from the vicinity of a wall and applied by spray technique on the experimental wall. The monitoring of the fungal growth and surface analysis was done during the period of 3 years.
The obtained results show good functional properties of the applied photocatalyticTiO2/Zn-Al coating. Furthermore, the results provedthe need for a long term monitoring of the coating functional properties in real environmental conditions in order to obtain measurable and valid values.