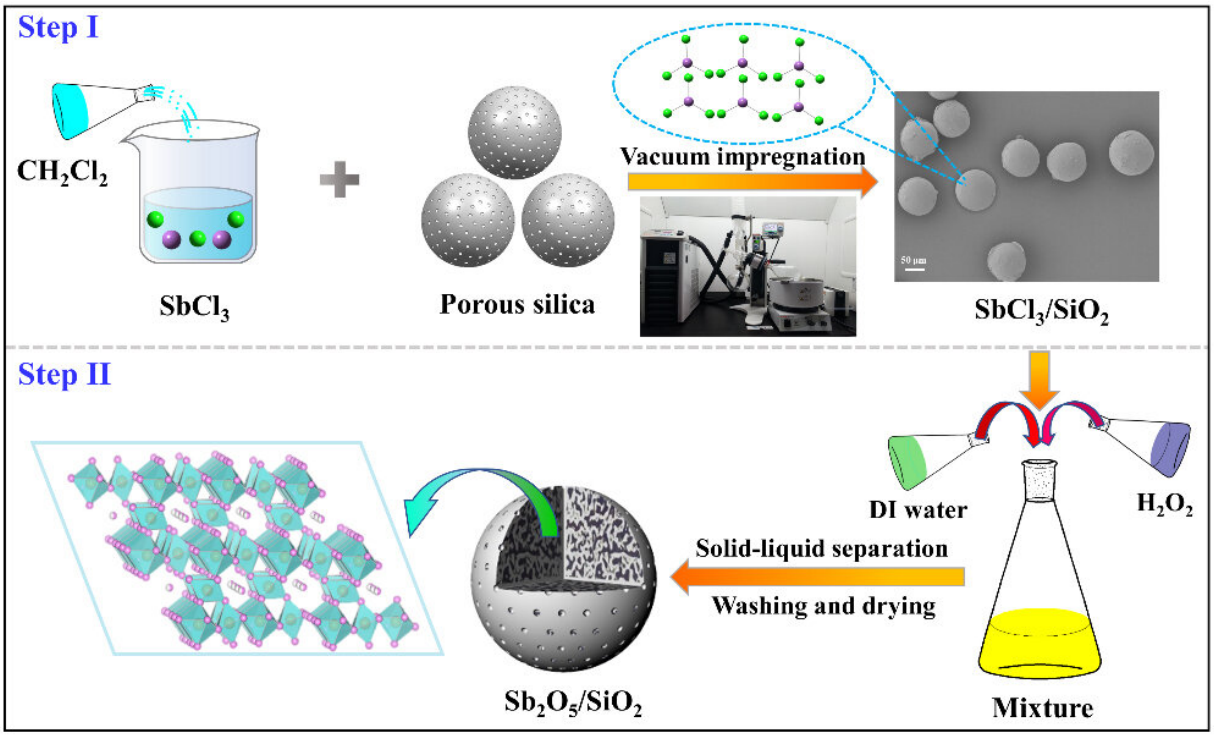
# New silica-based adsorbent developed for selective separation of radioactive strontium from acidic medium

June 29 2023, by Zhang Nannan



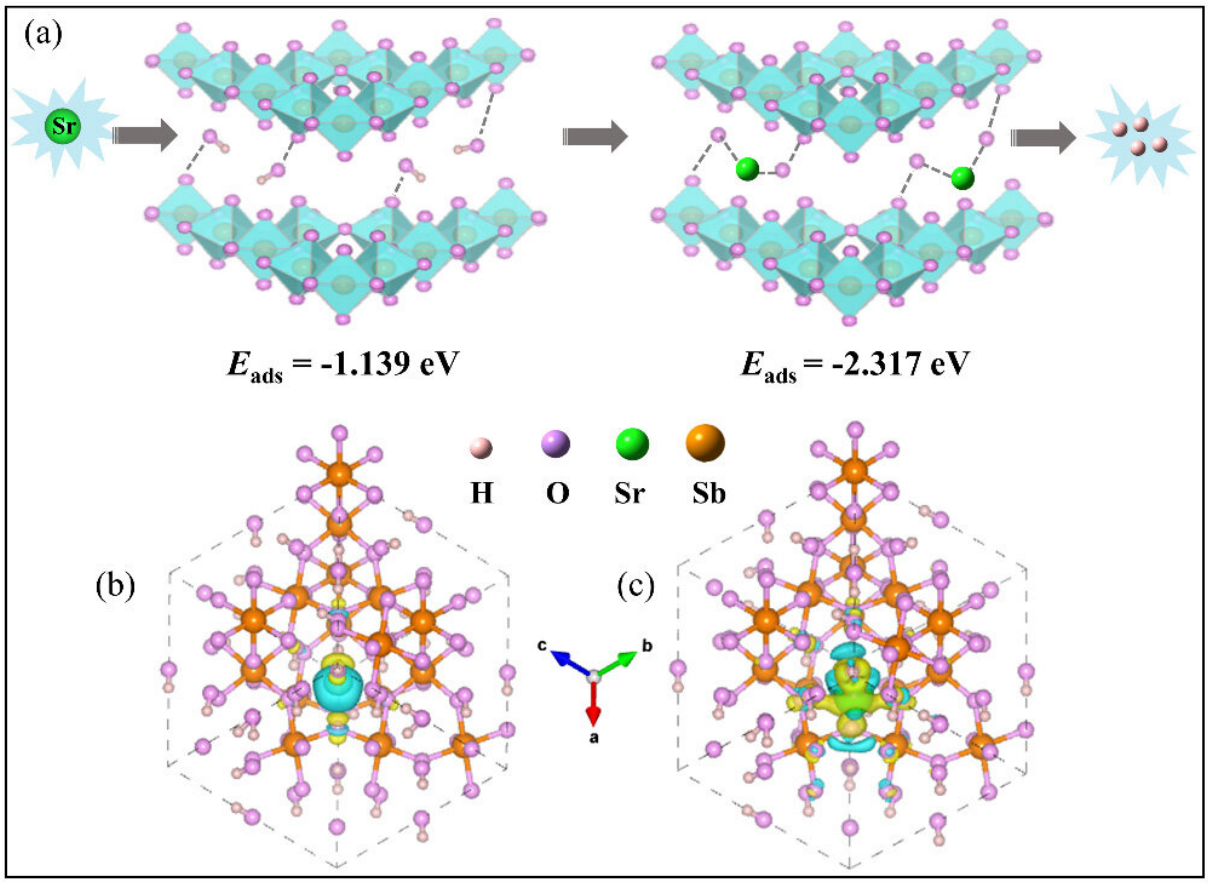

Schematic illustration of $SbCl_3/SiO_2$ and $Sb_2O_5/SiO_2$ preparation processes. Credit: Zhang Shichang

Prof. Huang Qunying's team from the Hefei Institutes of Physical Science of the Chinese Academy of Sciences has developed a novel

inorganic silica-based adsorbent for the highly selective separation of strontium from acidic medium. The results were published in *Separation and Purification Technology*.

Radioactive strontium ($^{90}Sr$) is considered to be one of the most dangerous radionuclides due to its high biochemical toxicity. During the vitrification process of high-level liquid waste, the presence of $^{90}Sr$ can cause instability of the vitrification substrate, resulting in radionuclide leaching. Removal of $^{90}Sr$ can reduce the heat generation and shorten the cooling time of the vitrification substrate in the repository, which is favorable for further deep geological disposal of the radioactive waste.

To address the above issues, Prof. Huang's team developed a novel silica-based adsorbent $Sb_2O_5/SiO_2$ by a two-step method, i.e., vacuum impregnation followed by oxidation, and investigated the adsorption behavior of the adsorbent on strontium stable nuclide in low and high acid mediums (i.e., pH 6 and 1 M $HNO_3$).




Adsorption mechanism and DFT calculations: (a) Schematic illustration of the adsorption mechanism; (b, c) Charge density difference of $Sb_2O_5$ before and after adsorbed Sr. Credit: Zhang Shichang

The experimental results showed that the prepared adsorbent possessed good acid resistance stability and exhibited favorable adsorption on strontium stable nuclide in both low and high acid mediums. The mechanistic results revealed that the adsorption mechanism was ion exchange, and the adsorption was accompanied by charge transfer and reduction of adsorption energy.

This study not only develops a novel method for the preparation of

highly stable silica-based adsorbent, but also provides relevant experimental data and theoretical basis for the selective separation of strontium in acidic environments.

**More information:** Shichang Zhang et al, Efficient separation of strontium in different environments with novel acid-resistant silica-based ion exchanger, *Separation and Purification Technology* (2023). DOI: 10.1016/j.seppur.2023.124347

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