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PII: S0079-6425(18)30002-1
DOI: https://doi.org/10.1016/j.pmatsci.2018.01.002
Reference: JPMS 488

To appear in: *Progress in Materials Science*

Received Date: 6 March 2017
Revised Date: 7 November 2017
Accepted Date: 5 January 2018

Please cite this article as: Vellingiri, K., Kim, K-H., Pournara, A., Deep, A., Towards high-efficiency sorptive capture of radionuclides in solution and gas, *Progress in Materials Science* (2018), doi: https://doi.org/10.1016/j.pmatsci.2018.01.002

Towards high-efficiency sorptive capture of radionuclides in solution and gas

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Abstract

As globalization and rapid population growth have raised global energy needs, the demand for nuclear energy has increased drastically. To make use of such energy reliably, the efficient disposal of nuclear wastes has become a major challenge. With this in mind, numerous research efforts have been made to store, capture, and immobilize radioactive waste. To date, a variety of sorbent materials with different physical, chemical, and structural properties have been discovered and tested for the capture of soluble and gaseous forms of a variety of radionuclides. In addition, the pre-/post-synthetic modification of these sorbent materials has gained significant attention in attempts to enhance their overall stability, tunability, and capacity, while also preserving the main framework. In this review, we explored the performance of different materials for the sorption of uranium, cobalt, europium, iodine, cesium, strontium, technetium, krypton, xenon, and argon. To begin with, we classified sorbent materials into three categories by considering their structural improvements over time. We also pointed out the structural importance, reversibility, and renewability aspects of the proposed sorbents along with their basic sorption properties. Finally, we proposed some future aspects of these materials by carefully listing their features, applications, and present limitations.

Keywords: *Sorbents, Nuclear Energy, Uranium, Radionuclide*

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