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Iodine Adsorption on Modified Nickel Oxide

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One of the most important fission products, considered in radioactive waste disposal, is radioiodine (^{131}I). The most notable iodine radioisotopes are ^{131}I and ^{129}I , with half-life 8 days and 15.7 million years respectively. They have potential radiological effect on the human body and the environment due to their large nuclear yield, volatility and especially accumulation in thyroid tissues. Therefore it is necessary to control their release from nuclear power plants and potentially from disposed radioactive waste.

The efficient adsorption unit for the atmosphere cleanup system is needed to capture the iodine isotopes. Activated carbon as adsorbent is widely utilised for this purpose. However, activated carbon has poor iodine retention at higher temperatures which are necessary during waste treatment. Another disadvantage of activated carbon is ignition change in presence of nitrogen oxides. Therefore, the development of new thermally stable adsorbents is envisaged.

In presented work, nanomaterials, based on pure nickel oxide, mixed nickel zinc oxide, or nickel oxide doped with silver were developed and tested as potential adsorbents for efficient iodine removal. Simple metal oxides exhibit sufficient radiation and thermal stability. Further improvement of sorption properties may be gained by the functionalisation of nanofiber materials with nickel oxide.

Tested powders were produced by photoinduced precipitation of solid precursors from aqueous solutions containing soluble nickel salts, followed by low temperature calcination.

The sorption properties of nanomaterials were tested by the method based on Standard Test Method for Nuclear-Grade Activated Carbon (ASTM D3803). In comparison with commercially available nickel oxide, newly developed materials show significantly higher sorption capacity.

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