

THE APPLICATION OF STABLE ISOTOPES OF RARE ELEMENTS

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In the last decades there has been a tendency of expanding the range of applications of the materials, metals and high purity compounds used in all branches of science and engineering. The use of rare elements has special significance for modern technology, metallurgical engineering and chemistry [1]. Scientists have learned to change the isotopic composition of elements for obtaining the specific properties of materials in technological activity. Many elements have a large number (more than twenty) of unstable (radioactive) isotopes (an overwhelming majority of them is created artificially). The number of stable isotopes (they exist independently for a long time) is considerably less and, besides, the even Z elements have the greatest variety of isotopes. The objective of the work was to study the application of stable isotopes of more than thirty rare elements.

Nuclear properties of isotopes are used in physics and chemistry: ^{93}Nb , ^{180}W , ^{182}W , ^{183}W , ^{170}Yb are required for research of the structure and characteristics of substances using methods of nuclear magnetic and recoilless nuclear resonance; radioactive isotopes ^{201}Tl , $^{114\text{m}}\text{In}$ and $^{113\text{m}}\text{In}$, $^{87\text{m}}\text{Sr}$ are prepared from ^{203}Tl , ^{113}In , ^{85}Rb for medicine; ^{92}Mo , ^{154}Sm and ^{160}Gd are used in neutron diffraction investigation; ^{46}Ti , ^{151}Eu , ^{159}Tb are practiced in detectors for different purposes; ^{75}Se , used in defectoscopy, is received from ^{74}Se . Gd, Eu, Sm, Hf are used for manufacturing control rods; ^9Be is a nuclear moderator and reflector; ^{113}In is a neutron defector; ^7Li is a reactor heat carrier. The most important elements for nuclear engineering are ^{157}Gd having the highest capture cross section of neutrons, and Zr, ^{93}Nb used in alloy of partition in nuclear fuel elements [2].

The isotopes of rare-earth and scattered elements are used in optics. ^{141}Pr , Se, Sm, Nd, Er, Yb, Dy, Hf are required for making glasses with special properties; Sr, Yb, ^{151}Eu , ^{153}Eu are employed in the production of phosphors; ^{89}Y , ^{159}Tb , ^{169}Tm , Gd are used in laser technology.

Ti, Zr, ^{51}V , ^{93}Nb , Mo, W, Te, ^{185}Re , ^{45}Sc are alloying additions and constructional materials used in aircraft engineering and rocket production. Such alloys become heat-resistant, anticorrosive and superconducting.

^{133}Cs is a material for an atomic clock. It is an accurate apparatus for chronometry. ^{51}V is used in thermochemical water decomposition. ^{139}La is one of the components of hybrid car accumulators. ^{181}Ta , ^{69}Ga , ^{71}Ga , ^{113}In , ^{203}Tl , ^{205}Tl , ^{185}Re play a role in precision and electric engineering, semiconductor industry. Se and Te are used in photocell in solar energy. The isotopes of Sm, Nd, Dy, ^{159}Tb , ^{165}Ho , ^{169}Tm are required for producing the electromagnets and magnetic alloys. ^{165}Ho , ^{159}Tb , ^{141}Pr , ^{89}Y , ^{185}Re are catalysts in petrochemical and chemical industries.

The number of industry brunches, in which we cannot, but use rare elements is growing with the intensive development of modern science and technology since potential possibilities of rare elements have not been exhausted.

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