Anomalous survival of endometallofullerenes under irradiation in reactor

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The mechanisms determining the anomalous stability of carbon cages of endometallofullerenes by neutron irradiation have been studied. There were synthesized the row of endometallofullerenes $Ln@C_{2n}$ and their water-soluble biocompatible derivatives. It was established the influence of neutron irradiation on stability and nuclear physical properties of endometallofullerenes and their derivatives being applicable in nuclear medicine, including ^{46}Sc, ^{140}La, ^{141}Nd, ^{153}Sm, ^{152}Eu, ^{154}Eu, ^{153}Sm, ^{160}Tb, ^{169}Yb, ^{170}Tm (isomers I and III), ^{177}Lu. Some of them are studied for the first time ($^{46}Sc_3N@C_{80}$; $^{141}Nd@C_{2n}$). Earlier it was revealed an anomalously high retention for a mixture of empty and endometallofullerenes of Sm in reaction $^{152}Sm@C_{2n}$ (n, γ) $^{153}Sm@C_{2n}$ (~80 %) [1]. However, $^{152}Sm@C_{82}$ chromatographically separated has shown in (n, γ)-reaction the magnitude of the retention of 17,5% that is typical for rare earths. It was confirmed our hypothesis proposed earlier [2] concerning the mechanism of the relaxation of carbon shell based on ultrafast non radiative processes (electrons “shake-off ”) [3].

The fullerenes medical applications assume the preliminary transformation of fullerenes into biocompatible water-soluble form. However, it is well known, that hydroxofullerenes in water solutions trend to be aggregated. For the control over processes of clustering (coalescing) and temporary stability of solutions hydroxofullerenes the small-angle neutron scattering method has been applied. The discussed results can become a basis for the creation of industrial effective preparations with nanomaterials.

[1] Grushko Yu. S., Alekseev E.G., Voronin V.V., Kolesnik S.G., Kolesnik S.N., Pershikova T.M., *Molecular Materials* **7**, 115 (1996).

[2] Grushko Yu.S., Khodorkovski M.A., Kozlov V.S. Kolesnik S.G., Shilin V.A., Grachev S.A., Artamonova T.O., *Fullerenes, Nanotubes and Carbon Nanostructures* **14**, 249 (2006).

[3] Averbukh V., Cederbaum L.S., *Phys. Rev. Lett.* **96**, 053401 (2006).