Contribution ID: **103** Type: **Verbal**

Primary radiolytic processes studied by positron annihilation and emission Moessbauer spectroscopy

The e+ fate since its injection into a liquid until its annihilation is described. There are several steps of the e+ evolution [1]:
1) energy deposition and track structure of fast positrons: ionization slowing down, thermalization, track structure, terminal positron blob, electrostatic interaction between e+ and radiolytic products in its blob, effect of local heating;
2) positronium formation in aqueous solutions and other molecular condensed media: the Ore model, quasifree Ps state, intratrack mechanism of Ps formation. Ps bubble models. "Non-point"positronium: wave function, energy contributions, relationship between the pick-off annihilation rate and the bubble radius;
3) fast intratrack diffusion-controlled reactions: Ps oxidation and ortho-para conversion by radiolytic products, reaction rate constants, interpretation of the PAL spectra in water at different temperatures.
Intratrack radiation chemical reactions in frozen solutions can be studied by means of the emission Moesbauer spectroscopy. Radioactive transformation of 57Co into 57Fe (E-capture by 57Co nucleolus) is accompanied by emission of several Auger-electrons having total kinetic energy about 6 keV. Emission of these energized electrons leads to formation of a cloud around Moessbauer 57Fe ion with a radius of about 100 Å containing (200-300) ion-electron pairs (H2O+, e- in case of aqueous solutions). Such a cloud (the Auger-blob [2]) is formed within 0.1 ps. Further fast intrablob processes (ion-electron recombination, electron localization and scavenging) can be observed experimentally via measuring of the yields of final chemically stable ions 57Fe^3+ and 57Fe^2+ by means of EMS. Observation of these processes is terminated by the lifetime of the excited Moessbauer nuclei 57Fe, which is about 100 ns. We have studied experimentally reaction ability of NO3- cations towards quasifree track electrons in frozen aqueous solutions of acids and salts [2]. It was shown that NO3- scavenges track electron more efficiently than H3O+, but only by a factor of 3. It is in a drastic contradiction with known behavior of nitrite ions in liquid water, where they are very efficient electron scavenger.

[1] S.V. Stepanov, V.M. Byakov, D.S. Zvezhinskiy et al., Advances in Physical Chemistry, vol. 2012, Article ID 431962, (2012)
[2] S.V. Stepanov, V.M. Byakov, Yu.D. Perfilev, L.A. Kulikov Bulletin of the Russian Academy of Sciences. Physics, Vol. 77, No. 6, pp. 770-774 (2013)

Primary author: Dr STEPANOV, Sergey (Institute of Theoretical and Experimental Physics)

Co-authors: Dr ZVEZHINSKIY, Dmitriy (Institute of Theoretical and Experimental Physics); Dr DUPLATRE, Gilles (Pluridisciplinaire Hubert Curien, CNRS/IN2P3, BP 28 67037 Strasbourg); Dr LEONID, Kulikov (Moscow State University); Prof. BYAKOV, Vsevolod (Institute of Theoretical and Experimental Physics); Prof. PERFILIEV, Yurii (Moscow State University)

Presenter: Dr STEPANOV, Sergey (Institute of Theoretical and Experimental Physics)

Track Classification: Radiation Chemistry