

Review of magnetic and spin effects in charge separated states in the triads "electron donor - hard molecular bridge - electron acceptor"

Lukzen N. N.^{1*}

¹ *International Tomography Center SB RAS, Insitutskaya 3a, 630090, Novosibirsk, Russia*

* E-mail: luk@tomo.nsc.ru.

The recombination of biradicals formed in course of photoinduced charge separation in a rigidly bound triad «electron donor/molecular bridge/electron acceptor» for a number of acceptors and donors with different rigid molecular bridge in a magnetic field is considered. The recombination of such biradicals into the ground diamagnetic state is spin-selective. The kinetics of formation and recombination (decay) of such charge separated states (CSS) has been studied in detail experimentally and theoretically in the range of magnetic fields from 0 to 1800 mT using flash photolysis with a resolution of tens of nanoseconds. It was shown that for several triads, the so-called J-resonance is observed, which has a width of several mT, which indicates the intersection of the of singlet (S) and triplet (T) levels separated by an exchange interaction in a zero magnetic field. The magnetic-field dependences of the CSS recombination kinetics were modeled quantum-mechanically, taking into account the five strongest hyperfine interactions and the anisotropic hyperfine interaction with the nitrogen nucleus. Both incoherent and coherent hyperfine interactions have been shown to contribute to the S/T spin conversion in all magnetic fields. Based on the analysis of the kinetic curves, it was found that the nanoviscosity in a polytetrahydrofuran solution, compared to a tetrahydrofuran solution, increases significantly less than the macroscopic viscosities of a polytetrahydrofuran solution vs tetrahydrofuran solution. The nanoviscosity changes by a factor of 24, while the macroscopic viscosity changes by a factor of ~1000.

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