Thus, the Monte Carlo numerical model of MSD with two erosion zones which was designed in previous articles [5–7] and has been improved in present work, clearly describes the discharge behavior in practically useful cases. It could be used for foreseeing the target sputtering efficiency on this magnetron sputtering device, which is important at thin film production.

References

1. Antonenko S.V. Issledovanie uglerodnyh nanostruktur, poluchennyh metodom raspylenija na postojannom toke / S.V. Antonenko, S.N. Mal'cev, A.A. Timofeev // Inzhenernaja fizika. – 2002, – №1. – P. 38–40. (in Russian). 2. Magnetronnaja tehnologija sozdanija grafitovyh pokrytij, nanotrubok, i nanostruktur na ih osnove, / S.V. Antonenko // Funkcional'nye materialy i vysokochistye veshhestva. – M.: 2007. – Rezhim dostupu: http://www.edu-cons.net/atlas_last/doc/444/Antonenko_rus.pdf. – Nazva z ekranu. (in Rus.). 3. Novye uglerodnye nanosistemy na osnove nanotrubok, fullerenov i ih proizvodnyh / Antonenko S.V, Malinovskaja O.S. // Funkcional'nye materialy i vysokochistye veshhestva, – M.: 2007. – Rezhim dostupu: http://www.edu-cons.net/atlas_last/doc/443/Antonenko_Mal_rus.pdf. – Nazva z ekranu. (in Russian). 4. Antonenko S.V. Mal'cev S.N. Poluchenie uglerodnyh nanotrubok metodom magnetronnogo raspylenija na postojannom toke / S.V. Antonenko, S.N. Mal'cev // Pribory i tekhnika eksperimenta. – 2005. – №3. – P.150–152. (in Russian). 5. Bogdanov R.V. Komp'yuterne modelyuvannya mahnetronnoho rozpylyuvanogo pristroyu z dvoma zonamy eriziyi / R.V. Bogdanov, O.M. Kostiukevych. // Visnik Kyyivskoho nacionalnoho universitetu imeni Tarasa Shevchenka. Seriya "Ffizyko-matematichni nauky", – 2012, – №1, – P. 249–260. (in Ukrainian). 6. The computer simulation of the sputtering magnetron device with two erosion zones and it comparison to experimental results / R.V. Bogdanov, O.M. Kostiukevych. // thesis of "XIIth International Young Scientists' Conference on Applied Physics", May, 23–26, 2012; – Kyiv, Ukraine, Taras Shevchenko Nat. Univ. Rad.-Phys. Faculty, – P.182-183. 7. Bogdanov R.V., Kostiukevych O.M.. Experimental investigation and computer simulation of the magnetron sputtering device with two erosion zones / R.V. Bogdanov, O.M. Kostiukevych // "Problems of Atomic Science and Technology" Series: Plasma Physics (19), – 2013. – No.1. – P.189–191. 8. Bultinck E. The effect of the magnetic field strength on the sheath region of a dc magnetron discharge / E. Bultinck, A. Bogaerts // J. Phys. D: Appl. Phys – 2008. – No.41, 20 2007, – P.1–5. 9. Bultinck E., Particle-in-cell/Monte Carlo collisions treatment of an Ar/O2 magnetron discharge used for the reactive sputter deposition of TiOx films / Bultinck, A. Bogaerts // New J. Phys., – 2009, – No.11, 103010, – P.1–25. 10. Kashtanov P.V. Magnetronnaja plasma i nanotehnologia / P.V. Kashtanov, B.M. Smirnov, R. Hippler // Uspekhi Fizicheskikh Nauk, – 2007, – №5, – T.177, – P.473–510. (in Russian). 11. Kucherenko E.T. Magnetronnoe raspylitelnoe ustroystvo s dvumua zonams eriziyi / E.T. Kucherenko // Plasmotehnologia-97: Sb. nauch. trudov.; Zaporozhye: RIP "Vidavets", 1997, – P.121–124. (in Russian). 12. Kuzmichev A.I. Magnetronnyie raspilitenye systemy. Kniga 1. Vvedenie v fiziku i tehniku magnetronnogo raspilenija. / A.I. Kuzmichev // Kiev: "Avers", 2008. – 244 p. – ISBN 966-8934-07-5. (in Russian). 13. Magnetic field improvement in end region of rectangular planar DC magnetron based on particle Simulation, / [Qiu Qingquan, Li Qingfu, Su Jingjing, Jiao Yu, Jim Finley] // Plasma Science and Technology, – 2008, – Vol.10, No.6, – P. 694–700. 14. Musschoot J. Influence of the geometrical configuration on the plasma ionization distribution and erosion profile of a rotation cylindrical magnetron: a Monte Carlo simulation / J. Musschoot, D. Depla, J. Haemers, R. De Gryse // Plasma Sources Sci. Technol., – 2006, – No.39, 015209, – P. 3989–3993. 15. Musschoot J. Investigation of the sustaining mechanisms of dc magnetron discharges and consequences for I-V characteristics / J. Musschoot, D. Depla, J. Haemers, R. De Gryse. // Plasma Sources Sci. Technol., 2008, – No.41, 015209, – P.1–5. 16. Soloviev A. A. Harakteristiki plazmy nesbalansirovannoj magnetronnoj raspylitel'noj sistemy i ih vlijanie na parametry pokrytij ZnO:Ga, / Soloviev A.A., Zaharov A.N., Rabotkin S.V., Oskomov K.V., Sochugov N.S. // Fizika i khimija obrabotki materialov, – 2009, – №2, – P.58–65. (in Russian). 17. Shirajev. S.A. Poluchenie i svojstva kompozicionnyh pokrytij na osnove metall-uglerod s nanokristallicheskoj strukturoj / Shirjaev S.A., Atamanov M.V., Guseva M.I., Martynenko Ju.V., Mitin A.V., Mitin V.S., Moskovkin P.G. // Zhurnal tekhnicheskoj fiziki, – 2002, – T.72, – Vyp. 2, – P. 99–104. (in Russian).

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ЗОНОВАНА МІШЕНЬ В ЕКСПЕРИМЕНТАЛЬНОМУ ДОСЛІДЖЕННІ МАГНЕТРОННОГО РОЗПИЛЮВАЛЬНОГО ПРИСТРОЮ З ДВОМА ЗОНАМИ ЕРОЗІЇ

Побудовано комп'ютерну модель магнетронного розпилювального пристрою з двома зонами ерозії, засновану на методі Монте-Карло, де введено алгоритм пошуку самоузгоджених стартових позицій вторинних електронів на катоді. Для перевірки результатів комп'ютерного моделювання було виготовлено зоновану тестову мішень для даного магнетронного розпилювального пристрою, яка забезпечила вимірювання розподілів розрядного струму по своїй поверхні. Порівняння результатів експерименту та моделювання продемонстрували їх відповідність за однакових умов.

Ключові слова: зонована мішень, магнетронний розпилювальний пристрій, катодний шар, комп'ютерне моделювання, метод Монте-Карло.

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ЗОНИРОВАННАЯ МИШЕНЬ В ЭКСПЕРИМЕНТАЛЬНОМ ИССЛЕДОВАНИИ МАГНЕТРОННОГО РАСПЫЛИТЕЛЬНОГО УСТРОЙСТВА С ДВУМЯ ЗОНАМИ ЭРОЗИИ

Построена компьютерная модель магнетронного распылительного устройства с двумя зонами эрозии, основанная на методе Монте-Карло, в которой введен алгоритм поиска самосогласованных стартовых позиций вторичных электронов на катоде. Для проверки результатов компьютерного моделирования была изготовлена зонированная тестовая мишень для данного магнетронного распылительного устройства, которая обеспечила измерения распределений разрядного тока по своей поверхности. Сравнение результатов эксперимента и моделирования продемонстрировало их соответствие при одинаковых условиях.

Ключевые слова: зонированная мишень, магнетронный распылительное устройство, катодный слой, компьютерное моделирование, метод Монте-Карло.

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SUBNANOSECOND STIMULATED RAMAN SCATTERING PULSES OF Q-SWITCHED LASER AT SELF-FOCUSING

The results of experimental study confirm the availability of using self-focusing media for creation of highly efficient transformers of laser radiation based on stimulated Raman scattering. It has been shown that due to the self-focusing dynamics, such transformers can change frequency and compress giant pulses of multimode lasers more than in ten times, utilizing a simple scheme. The proposed and implemented scheme is suitable for generation of initiating subnanosecond Stokes pulses, which further can be used for compression of giant laser pulses with a corresponding increasing of power.

Keywords: laser, self-focusing, stimulated Raman scattering.

Introduction. It is known that SRS (stimulated Raman scattering) is successfully used in transformers of laser radiation for frequency tuning, pulse compression and improving of optical beam quality [6, 1]. However, SRS-

active media, which have practical use, are limited to hydrogen and methane (at pressure of tens of atm) or certain crystals. Such available, optically stable and easy to use media as self-focusing liquids (benzene, toluene, etc.), there historically first SRS was observed [9], were neglected because of unsuccessful attempts to create the highly efficient quantum electronics devices. This narrows the range of radiation frequencies that can be obtained from a laser, and thus reduces the value of SRS as a method of frequency tuning.

In self-focusing liquids, experimental threshold of SRS is defined by critical power of self-focusing [2] and achieved very easily. However, there are significant complications to achieve the high energy conversion efficiency of laser radiation. Mostly, in self-focusing liquids conversion efficiency in the first Stokes SRS component does not exceed ~20% under the excitation by a giant pulse of a multimode laser and in all Stokes components it is ~ 30%. This situation was classified as an effect of "absolute saturation of stimulated scattering" [7] the nature of which remains until now unclear. Nevertheless, the main problem is effect of small-scale self-focusing.

In our opinion, SRS-based transformers with high conversion efficiency still can be created in self-focusing liquids, but in two stages - in a two-cell scheme. Namely, a seed pulse is generated under forward or backward SRS in a cell where the threshold of self-focusing is exceeded, and then is enhanced below threshold of self-focusing in the second cell. It is important that, besides of achievement of the high overall conversion efficiency in the two-cell scheme, in the first cell it can possible to reduce simultaneously a pulse duration (and hence, as a result, to compress the pulse) using dynamic of self-focusing process.

In addition, it should be noted that the most important practical results of solving the problem of increasing the SRS effectiveness in self-focusing liquids is closely linked to the availability of the exciting laser. Therefore, it is particularly important to solve a complex problem: the efficient conversion of the available multimode laser radiation and at the same time improving the optical quality of the radiation. The above circumstances stimulated experimental research described in this work.

Thus, the work is aimed to obtain Stokes subnanosecond pulses in self-focusing SRS-active liquids under the excitation by multimode Q-switched laser. These pulses can be used as initiators in the gain stage and can define the temporal-spatial characteristics of the converted laser radiation.

Results of experimental studies. The multimode ruby laser with the linear resonator of 35 cm-length and with passive switching of resonator quality was used. The laser radiated light pulses at a wavelength 0.6943 μm with the energy 0.6 J. Duration of pulses was τ_L =30 ns at half level of intensity. The root mean square of the pulse energy variation was 5%. An envelope of the laser pulse (recorded by C7-10B oscillograph) was smooth. The hath-width of the pulse spectrum (measured using a Fabry–Pérot interferometer with a ring thickness 30 mm and sharpness $F^*\approx 20$) was 0.01 cm^{-1}, which is less than the spectral distance between two longitudinal modes of the empty laser cavity (0.014 cm^{-1}). The laser beam at an intersection (with the diameter of about 1 cm) was heterogeneous with a large number (10^2) maxima and minima of intensity.

For this laser, the threshold of SRS was exceeded in 3.5 times without addition focusing in the cell of 25cm-length with toluene (C_6H_5-CH_3). The conversion efficiency into all Stokes components, propagating in the direction of the excitation beam, was approximately 20% of the laser pulse energy. Forward SRS-pulse duration ranged from 15 ns to 25 ns, that is not less than half the duration of the laser pulse.

For obtaining and registration of short pulses of Stokes SRS, the optical scheme shown in Fig. 1 was used.

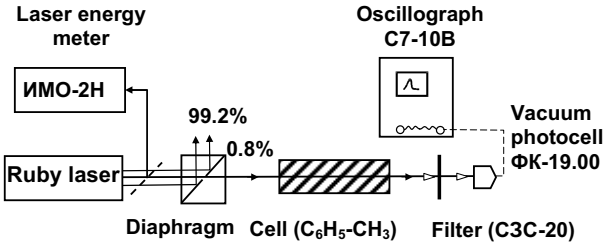

Fig. 1. Optical scheme

Laser radiation partially (0.8%) passes through the diaphragm and reaches the 25 cm-cell with toluene. Optical filter СЗС-20 after the cell absorbs laser radiation. Scattered light (mostly first Stokes SRS) after passing through the filter enters the registration scheme. The registration scheme consists of a photovoltaic vacuum cell ФК-19.000 (rise time from 0.1 to 0.9 of maximum value of the current pulse less than 0.7 ns) and the oscillograph C7-10B with a signal delay line (a bandwidth of the delay line is at least 650 MHz with the recession 3dB).

The diaphragm (Fig.1) is formed by two 90^0-prisms, which hypotenuse surfaces have an optical contact of limited area with glycerin. The surface of the optical contact in the form of a disk has a diameter $D\approx 0.4$ mm. Compared to a conventional diaphragm, such diaphragm has an advantage. Namely, at powerful light pulse (~20MW at used laser), optical breakdown is prevented on its boundary. In addition, the laser radiation, which does not pass the diaphragm (99.2%), can be used in the gain channel.

The diameter D=0.4 mm of the diaphragm aperture was chosen based on the fact that in toluene the laser beam fragments into individual parts which self-focus independently. Applying the registration scheme for obtaining the spatial-angular spectra and the calculation procedure described in works [3, 4], it was determined that at the cell entrance, the average diameter of these fragments of the laser beam was $d\approx 0.23$ mm. In the cell with toluene at the diameter ratio $D/d<2$, with high probability not more than one self-focusing focal point is formed simultaneously and, thus, formation of many independent sources of SRS with different phase, spatially localized within focal area, is prevented.

The distance 5 cm between the diaphragm and the cell was selected experimentally to make sure that the SRS threshold is exceeded for each laser pulse, under the given instability of spatial and temporal characteristics the used multimode laser.

In the case of increasing distance between the diaphragm and the cell to 10cm, the threshold of SRS was not achieved. It is consequence of the beam diffraction at the distance between the diaphragm and the cell. As a result of the diffraction an area of self-focusing was not formed.

Radiation energy passed through the diaphragm was approximately 4mJ. It is only 0.8% of the total energy of the laser pulse. Under these conditions, the average pulse energy of SRS was 0.15 mJ, which corresponded to the energy conversion efficiency of laser radiation 4%, significantly less than the conversion efficiency in the absence of the diaphragm.

Fig. 2 shows oscillograms of the laser (a) and SRS (b) pulses without the diaphragm and of the laser (c) and SRS (d) pulses after the diaphragm. For emphasize the differences in the shape and duration, all pulses in Fig. 2 were normalized so that their amplitudes were the same.

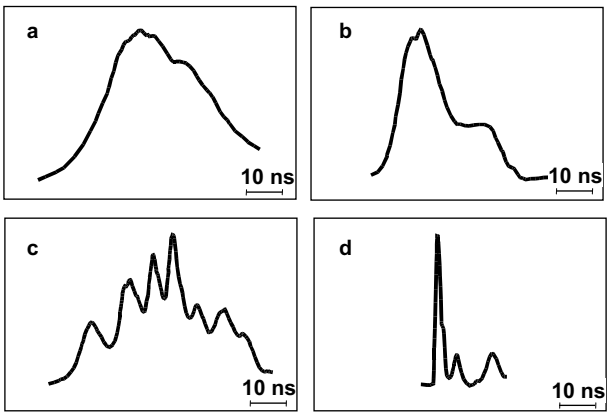

Fig. 2 Oscillograms of pulses: laser (a) and SRS (b) pulses without the diaphragm; laser (c) and SRS (d) pulses after the diaphragm

The oscillograms of laser pulses after the diaphragm (Fig. 2, c) have almost 50% modulation with period of about 7 ns. Note, for the laser resonator length 35cm, longitudinal modes beating would lead to a modulation with a period of 2.3 ns. So, the modulation should be attributed to the beating of transverse modes or deformation of mode structure of the beam in the process of generation.

The oscillogram of SRS pulse (Fig. 2, d) shows that in the proposed scheme, under using the diaphragm, subnanosecond pulse duration of SRS can be obtained. The duration of SRS pulses at half the level of intensity was less than 1 ns.

Quite often, even with constant experimental conditions, after the first pulse of SRS, one or two pulses were observed additionally. They were usually longer and have a lower amplitude. Period of these pulses closely correlates with the period of oscillation of intensity laser radiation after the diaphragm (Fig. 2, c).

Analysis and conclusion. The experimental data allow us to evaluate the effectiveness of SRS in a separate focal area. Assuming that the laser pulse has duration τ_L =30 ns at the half level of intensity and energy E_L =4 mJ after the diaphragm, we obtain the value of the laser power $P_L = E_L / \tau_L$ =133 kW. The critical power for self-focusing in toluene is P_{CR} =25 kW [4]. As the SRS-threshold and, hence, the threshold of self-focusing in the absent of the diaphragm was overcame in μ =3.5 times, we can evaluate the power of the laser radiation which self-focusing in separate focal area after entering the diaphragm: $P_L^* = k\mu P_{CR}$ =80 kW, where k =0.92 is a loss factor due to the light reflection at the outer sides of the diaphragm. Thus, in the focal region it was 60% of the radiation passed the diaphragm. The other part of the radiation (40%) was not involved in the generation of SRS-pulse.

If in the focal region the full depletion of the laser pulse at SRS takes place, then the amplitude of SRS pulse in the oscillograms must be also 60% of the laser pulse amplitude. In the experiment, the amplitude ratio of SRS/laser pulses (after taking into account the filter transmission and the spectral sensitivity of the photocell) reached 0.5. It can be concluded that the energy conversion efficiency of laser radiation in the focal region reached in the experiment the value of about 0.5/0.6≈0.8 (80 %), and quantum efficiency was 86 %.

Hence, achieving the high conversion efficiency of the laser radiation in SRS-active self-focusing fluids in principle is possible. The effect of "absolute saturation of stimulated scattering" [7] has not fundamental nature.

The obtained value for the conversion efficiency indicates that the use of approximations of a given excitation field and the field of first Stokes SRS [5] or a given excitation field and the exponential growth of the first Stokes component [8] to describe the SRS at self-focusing is incorrect. At the same time, the model of deep depletion of exciting radiation in the self-focusing focal areas [4] gets the further experimental confirmation in the present work.

A flat decline of Stokes pulse compared with its front, in our opinion, is partially due to uncontrolled parasitic feedback, which leads to the subthreshold generation of SRS. The repeated pulses of low amplitude and longer duration (Fig. 2, d) are reinforced echo the main pulse.

Such complications can be avoided by using two-component cell. In the first long part of the cell will be self-focusing liquid with a different Raman frequency, and in the second short part – basic liquid, as in the gain stage. The two-component cell may have other advantages, because it makes better use of self-focusing dynamics [3].

The proposed and implemented simple scheme is suitable for generation of initiating subnanosecond Stokes pulses, which further can be used for more then 20 times compression of giant laser pulses with a corresponding increase in power.

Reference

1. Boyd R.W., Lukishova S.G., Shen Y.-R. Self-focusing: past and present. Fundamentals and prospects.– New York, 2009. 2. Ivanisik A. I., Malyi V. I., Ponezha G. V. Spatial-angular structure of anti-Stokes radiation formed by stimulated Raman scattering in a Kerr liquid // Optics and Spectroscopy.– 1996. – Vol. 80, No. 2. – P. 185–189. 3. Ivanisik A. I., Malyi V. I., Ponezha G. V. Stimulated Raman scattering in self-focusing environments: new methods for experimental studies // Bulletin of Taras Shevchenko national university of Kyiv. Series: Physics & Mathematics. – 1997. – No. 4. – P. 239–248. 4. Ivanisik A. I., Malyi V. I., Ponezha G. V. Effect of Self-Focusing on the Angular Spectra of Stimulated Raman Scattering // Optics and Spectroscopy.– 1998. – Vol. 85, No. 1. – P. 78–84. 5. Lugovoi V. N., Prokhorov A. M. Contribution to the theory of stimulated Raman scattering in focused light beams // JETP.– 1975. – Vol. 42, No. 1. – P. 42–46. 6. Smirnov V. G. Unconventional principles for designing high-power lasers with nonlinear frequency converters // Quantum electronics. – 1993.– Vol. 23, No. 5. – P. 361–379. 7. Sokolovskaya A. I., Kudryavtseva A.. D, Brekhovskih G. L. New optical phenomena at Raman light scattering in condensed matter // FIAN proceedings. – 1991. – Vol. 212. – P. 16–37. 8. Venkin G. V., Klyshko D. N., Kulyuk L. L. Angular structure of higher components of stimulated Raman scattering of light // Quantum electronics. – 1977.– Vol. 7, No. 5.– P. 550–553. 9. Woodbury E. J., Ng W. K. Ruby laser operation near IR // Proc. IRE.– 1962. – Vol. 50. – P 2367–2369.

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СУБНАНОСЕКУНДНІ ІМПУЛЬСИ ВИМУШЕНОГО КОМБІНАЦІЙНОГО РОЗСІЮВАННЯ ЛАЗЕРА З МОДУЛЯЦІЄЮ ДОБРОТНОСТІ РЕЗОНАТОРА ЗА САМОФОКУСУВАННЯ

Результати експериментальних досліджень підтверджують перспективність використання самофокусуючих середовищ для створення високо ефективних перетворювачів лазерного випромінювання на основі вимушеного комбінаційного розсіювання. Показано, що завдяки динаміці самофокусування, в таких перетворювачах можна змінити частоту та за простою схемою більше, ніж у десять разів, компресувати гігантські імпульси багатомодових лазерів. Запропонована та використана схема придатна для генерації ініціюючих субнаносекундних стоксових імпульсів, які далі можуть використовуватися для компресії гігантських лазерних імпульсів з відповідним зростанням потужності.

Ключові слова: лазер, самофокусування, вимушене комбінаційне розсіювання.

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СУБНАНОСЕКУНДНЫЕ ИМПУЛЬСЫ ВЫНУЖДЕННОГО КОМБИНАЦИОННОГО РАССЕИВАНИЯ ЛАЗЕРА С МОДУЛЯЦИЕЙ ДОБРОТНОСТИ РЕЗОНАТОРА ПРИ САМОФОКУСИРОВАНИИ

Результаты экспериментальных исследований подтверждают перспективность использования самофокусуючих сред для создания высоко эффективных преобразователей лазерного излучения на основе вынужденного комбинационного рассеивания. Показано, что благодаря динамике самофокусирования, в таких преобразователях можно изменить частоту и с использованием простой схемы компрессировать, более чем в десять раз, гигантские импульсы многомодовых лазеров. Предложенная и использованная схема применима для генерации инициирующих субнаносекундных стоксовых импульсов, которые далее могут использоваться для компрессии гигантских лазерных импульсов с соответствующим возрастанием мощности.

Ключевые слова: лазер, самофокусировка, вынужденное комбинационное рассеивание.

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CHARACTERIZATION OF FULLERITY DERIVATIVES FOR ORGANIC PHOTOVOLTAICS

The fullerity C_{mn} derivatives were prepared by light illumination and ozonolysis of C_{60} gel solution. Experimental investigation was carried by UV-vis, IR, Raman spectroscopy, XPS and AFM. The structure of C_{mn} derivatives in gel solution (aggregates with hydrated shell) was studied. I present results from initial screening of the candidates based on informatics quantitative structure – property relationships, their comparison with results from density functional theory calculations about the effect of donor-acceptor architectures on the efficiency of the photovoltaic device.The comparison of spectral features for C_{mn} derivatives with the data for the adsorbed layers allowed to detect a series of C_{mn} hydroxyl group of derivatives.

Keywords: fullerity fullerol, hydroxyl-, epoxy-, keto- derivatives, electronic structure, surface-enhanced infrared absorption.

Introduction. Organic photovoltaic devices appear considerably cheaper and simpler in application, than traditional elements. Distribution of this technology is restrained by two important factors: not high (less than 9 %) efficiency of transformation and small works. It is considered that their commercial prospects depend on that, whether they will manage to attain ten percent efficiency at the simultaneous increase of calculation resource to ten thousand clock. These devices have recently reached 15 % efficiency and lifetimes close to 20 years; the search for the best (co)monomers for donor polymers being based on exacting experimental synthesis (Fig. 1).

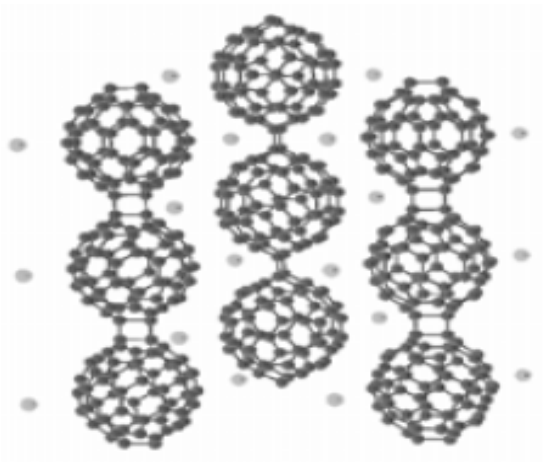

Fig. 1. Fullerity C_{m60} in polymer chains [1]

The design, automation and calculation of million organic molecules allow the screening of the best candidates for further study. Current applications of biosolutions with fullerity C_{m60} and they derivatives in molecular electronics are based on their behavior as active photosensitizer [1÷5]. These features originate from known energy levels diagram (Fig. 2) of the photosensitized generation of singlet and triplet. Fullerity C_{m60} and its derivatives can be photosensitizer due to a strong absorption of light throughout the UV and visible regions and the low energy gap between the excited singlet and triplet states ($5{,}8 \cdot \text{kcal/mol}$) facilitating efficient intersystem crossing. High yield of the triplet state, > 95%, provides an efficient generation of singlet excite. Also, C_{60} is a acceptor of photoelectrons with the ability to accommodate up to several electrons reversibly [1, 6].

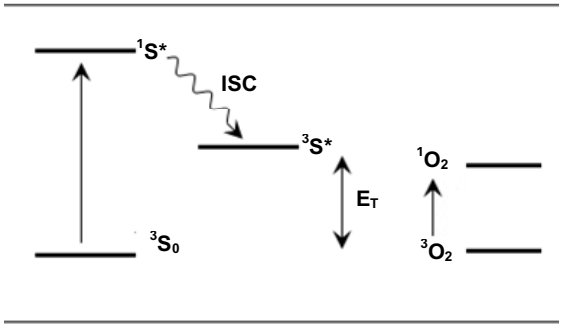

Fig. 2. Diagram of the energy levels in the photosensitized generation of singlet ($^1O_2$). ^1S, $^1S^*$, $^3S^*$ are the singlet ground state, the singlet excited state, and the triplet excited state, respectively, of the sensitizer S (C_{60}). $^3O_2$ and $^1O_2$ are the triplet ground and singlet state, respectively, of oxygen. Next transitions correspond: $^1S \rightarrow {}^1S^*$ absorption; $^1S^* \rightarrow {}^3S^*$ intersystem crossing (ISC); $^3S^* + {}^3O_2 \rightarrow {}^3S + {}^1O_2$ energy transfer. The energy transfer is possible if $\Delta E_T > 100\,\text{kJ/mol}$ [1]

Physical and chemical properties of fullerity C_{m60} and they derivatives in gel solutions such as their structure (aggregates with hydrated shell), chemical and electronic structure were studied recently in respect to the photoinduced change transfer [1÷5]. However, experimental investigation of the behavior of fullerity C_{m60} showed that it can be easily modification over light and very short time of charge transfer from donor to acceptor occurs [5, 8]. Also, the singlet excited exits very short time and these systems do not have applications in molecular electronic. Polymeric derivatives of fullerites in solutions