USE OF PLASMA OF PULSED UNDERWATER DISCHARGE FOR OBTAINING COMPOSITE POLYMER NANOMATERIALS [[1]](#footnote-1)\*)

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Sirotkin N.A., Khlyustova A.V.

G.A. Krestov Institute of Solution Chemistry of the RAS, Russia, Ivanovo, [alexsad8@yandex.ru](mailto:alexsad8@yandex.ru)

In accordance with the Roadmap for the Development of Works in Plasma Physics and Its Applications [1], the study of discharges in liquids and in contact with them is one of the priority areas. Interest in gas discharges in contact with liquids is due, first of all, to the possibilities of practical application of such discharges, among which are the modification of polymeric materials [2] and the possibility of forming micro- and nanostructures [3]. When using discharges with two electrodes located in a liquid, the formation of plasma is possible in vapor-gas bubbles arising as a result of local overheating of the solution near the electrode, or the formation of plasma "streamers" is possible. In this case, the destruction of the electrodes and the subsequent dispersion of nanoparticles in the liquid occur, accompanied by their rapid “quenching”. It has also been found that plasma in contact with liquids is an effective method for modifying various polymeric materials. This processing option is promising, since it eliminates the use of vacuum plants and solves the problem of compatibility of the new process with traditional liquid-phase technologies. In addition, in plasma-solution systems, the generation of chemically active particles occurs not only in the plasma zone, but also directly in the solution, which should significantly increase the efficiency of initiating homogeneous and heterogeneous chemical processes. During plasma-chemical processing, the formation of new oxygen-containing (C = O, C-OH) functional groups occurs, the processes of cross-linking and degradation of polymers occur. Plasma-modified polymers can be used as matrices for the impregnation of nanoparticles. However, it should be noted that there are almost no works where the initiation of the discharge and the simultaneous formation of nanoparticles would occur in a polymer solution or in an aqueous dispersion of a dissolved polymer. Meanwhile, this would make it possible to obtain unique composite polymeric materials in one stage and combine the processes of modifying polymers with the formation of nanoparticles.

This study presents the results of using an underwater pulsed discharge plasma for the one-stage fabrication of composite polymer materials containing metal oxide nanoparticles, as well as data on the use of the obtained composites in photovoltaics and for the fabrication of dye-sensitized solar cells.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Lt/ru/ET-Sirotkin.docx) [↑](#footnote-ref-1)