# Submicron Composite Electrospun – Fibers of Polymethylmethacrylate and Polycaproamid

**G.T. Smagulova, Y.T. Aliev, B.T. Lesbayev, A.Y. Bakkara, G.T. Ustaeva, N.G.Prikhodko, Z.A. Mansurov**

The Institute of Combustion Problems, p/o 050012, Bogenbay Batyr Str., 172, Almaty, Kazakhstan
smagulova.gauhar@inbox.ru

**ABSTRACT**

At present, the development of chemical technology of fibrous materials is depend of unusually wide range of properties and applications of these fibers, their indispensability at everyday life, techniques, science, medicine, etc. Among the various methods of ultra-thin fibers producing, electrospinning has a special place because of generality of this method. Nowadays, a wide variety of plants for electrospinning are developed and implemented [1,2] which allow to automate this process, increase productivity and produce fibers with desired properties.

At present paper experiments on producing of ultrathin fibers were carried out on traditional installation of electrospinning. For producing of composite fibers were used 2 solutions of polymers: PMMA/dichloroethane and polycaproamid/formic acid. For modifiers saturated solutions of various salts were used: $CoCl_2$, $SnCl_2$, $La(NO_3)_3$. To determine the structure and morphology, the resulting fibers were examined by scanning electron microscope, and elemental analysis of fibers was carried out. Results analysis showed that composite fibers without salts addition have a small variation in the diameter in range of 200-800 nm, and fibers have a band structure. In case of use of $CoCl_2$, the diameter of modified composite fibers is 300 nm - 1.6 micron, and particles of cobalt chloride introduced into the fiber structure. If introducing $SnCl_2$ salt, diameters of resulting fibers are in range of from 700 nm to 1.8 microns, and $SnCl_2$ particles are locating on fiber surface and have size of 200 to 600 nm. In the case of $La(NO_3)_3$ produced fibers have a heterogeneous structured surface.

Introduction of additional compounds to polymer / solvent (in this case, the saturated salt solution) leads to significant affect of viscosity value and viscosity coefficient of polymer systems as soon as in this case salt plays the role of surface active agent. This effect may be reflected in the structure of the fibers and on the basis of these fibers prerequisites for producing filters and sorbents are possible. Existing of modifier additive in fiber structure may affect on selectivity of filters. However, these assumptions require further research. Earlier works on production of modified PMMA fibers/ $La(NO_3)_3$ [3] have shown that under certain conditions it is possible to receive lanthanum metal encapsulated to polymer fiber.

Experimental results show that electrospinning method allows obtaining composite fibers and modified composite fibers from different polymers. During formation of fibers the choice of solvents for the composite polymer and modifying compound plays important role. Modifying additives may have different nature and variously implemented to structure of producing fiber. For example, in case of $CoCl_2$ salt particles were introduced directly into fiber structure. During implementation of $SnCl_2$ salt particles were on the fiber surface. If further treatment of received modified fibers is possible to produce carbon nanofibers decorated with comprising salts metal nanoparticles. These results illustrate the effectiveness of electrospinning method for producing active particles (aluminum nanoparticles, enzymes, etc) which are encapsulated to polymer matrix. These fibers can be used in various fields of science and technology as efficient electrodes, sensors, filters, etc.

**References**

1. Haitao Niu, Xungai Wang, Tong Lin. Upward Needleless Electrospinning of Nanofibers. // Journal of Engineered Fibers and Fabrics SPECIAL ISSUE - July 2012 – FIBERS. P. 17-22.
2. Sutana Sakuldao, Tipaporn Yoovidhya, Saowakon Wongsasulak. Coaxial electrospinning and sustained release properties of gelatin-cellulose acetate core-shell ultrafine fibres. // Science Asia. – 2011. - № 37. P. 335–343.
3. Смагулова Г.Т., Лесбаев Б.Т, Баккара А.Е., Алиев Е.Т., Рахымбаева Н.Б.,. Мансуров З.А. Получение модифицированных волокон полиметилметакрилата методом электроспиннинга. // Горение и плазмохимия. – 2012. – Том 10. - № 3. – С.219-225.