HYBRID ELECTRON-BEAM PLASMA REACTORS FOR THE PROCESSING OF POLYMERIC MATERIALS USED IN BIOLOGY AND MEDICINE: EXPERIMENTAL SET-UP AND TEST STUDIES

Vasilieva T.M.

JIHT RAS, Moscow, Russia
tmvasilieva@gmail.com

Application and perspectives of plasma chemical rectors generating cold hybrid plasma for polymeric materials biocompatibility improvement are considered. Oxygen hybrid plasma was produced by joint action of a continuous or intermittent electron beam (EB) and a capacity coupled RF-gas discharge (13.56 MHz) on gaseous media at moderate pressures (5-10 Torr). The scanning EB (accelerating voltage 30 kV and beam current 1-1.5 mA) was injected through the grid of the active RF-electrode while a polymeric material was placed in the gap between electrodes of RF-discharge system. The main hybrid reactor advantages are as follows:

1. The reaction volume is uniform and doesn't contract with the increase of the plasma generating gas pressure to values at which the RF-discharge is filamentary or does not glow at all;

2. Electron beam scanning can instantly control the reaction volume geometry, while active plasma particles concentrations can be controlled by the beam power independently. This makes it possible to accurately localize the RF-discharge on the desirable polymer surface zone and control its temperature. As a result, areas within which physical, chemical and functional properties change abruptly (structured patterns) or smoothly (gradient materials) can be formed on the surface.

Polymethylmethacrylate, polyethylenterphtalate films as well as 24-well polycarbonate cell culture plates (Corning, USA) and denture base "Villacryl H Plus" were used for test experiments. The hybrid plasma treatment resulted in oxygen-containing polar hydroxyl, carbonyl, and carboxyl groups formation in the polymers' surface layers. Surface free energy increase and wettability enchantment up to 1.5-2 times in comparison with original polymers were observed as well. The changes in the chemical composition of the polymeric surface together with the rise of its hydrophilic properties associated with the improvement of compatibility of the plasma-modified polymers with living cells and tissues. Thus, the hybrid plasma and hybrid type EB plasma chemical reactors seem to be perspective for obtaining biocompatible polymers for various biomedical purposes.

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