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Amphiphilic PE/PEO plasma co-polymers for tunable cell adhesion

Andrey Shukurov[1], Ivan Gordeev[2], Iurii Melnichuk[1], Daniil Nikitin[1], Tereza Steinhartova[1], Mykhailo Vaidulych[1], Jessica Ponti[3], Chiara Uboldi[3], Danka Slavinska[1], Hynek Biederman[1]

[1]Charles University in Prague, KMF MFF, Prague, Czech Republic [2]Jan Evangelista Purkyne University in Usti nad Labem, Usti nad Labem, Czech Republic [3]European Commision Joint Research Centre, Institute for Health and Consumer Protection, Ispra, Italy

choukourov@kmf.troja.mff.cuni.cz

Mixing of thermodynamically incompatible polymers may lead to phase separation which can be of use for tailoring of the properties of such blends at nanoscale. Here, plasma-assisted vapor phase co-deposition of poly(ethylene) (PE) and poly(ethylene oxide) (PEO) was performed to mix both components in the form of thin films. The composition of the blends was controlled by varying the supply of individual polymers whereas the discharge power was held constant at 15 W. SPM methods were used to detect micro-phase separation, the mechanism of which was dependent on the ratio between PE and PEO. For PE-rich mixtures, nucleation and growth of spherical PEO domains was observed with average height of 22 nm and average diameter of 170 nm. For PEO-rich mixtures, the mechanism changed to spinodal decomposition that led to the formation of bicontinuous structures with the characteristic domain size of 50-70 nm and domain spacing of 300-400 nm. The availability of hydrophobic (PE, WCA=101°) and hydrophilic (PEO, WCA=43°) domains provided these plasma co-polymers with amphiphilic properties with the wettability precisely tuned by the ratio between the two polymers. Seeding with the Balb/3T3 immortalized mouse fibroblast cells showed that the cell response was controllable by the amount of the non-fouling PEO component, and therefore the films can be attractive in protein- and cell-mediated applications.

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