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Surface nano-structuring of amphiphilic copolymer thin films via plasma polymerization

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Plasma copolymerization is becoming an attractive technique for the deposition of thin films by pulsed discharge of organic monomers vapors because of it's possibility to prepare tailored films with pre-defined surface characteristics. The plasma copolymerization of carefully selected monomers may open new options to tailor a surface by combining properties of each of the monomers.
Our objective is to study the growth and the film chemistry of copolymer thin films obtained by varying the operational plasma parameters. This approach of plasma copolymerization of two antagonist monomers (e.g. polar and apolar), aims to control the distribution and size of nodules of one of the monomers dispersed in the other phase.
in the present work, amphiphilic coatings with nano-heterogeneity have been obtained by plasma co-polymerization of 1H, 1H, 2H-perfluro-1-decene (HDFD) and 2-(N,N-dimethylamino) ethyl methacrylate (DMAEMA) under low pressure RF reactor using pulsed mode. Thin films with different plasma parameters were prepared by varying the peak power (Ppk), the partial pressure ratio (PHDFD = PDMAEMA, PHDFD > PDMAEMA, PHDFD < PDMAEMA), time of deposition and pulse time. The characterizations of surface heterogeneous films were done by contact angle goniometry, profilometry, FTIR, XPS and AFM. The resulted structuration leads to a surface with morphologic and topographic surface heterogeneity in the nanoscale, giving an interesting opportunity to combine the advantages of each of the monomers. (HDFD for antibacterial, DMAEMA for gas separation, immobilization of human living cells...).

Keywords
plasma copolymerization
pulsed discharge
amphiphilic
nanostructuration