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Amino and carboxylic group-containing films – comparison of plasma polymers and electrospray-deposited polyallylamine and polyacrylic acid films

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Amino and carboxylic groups at polymer surfaces are important as anchoring points for grafting aldehydes, isocyanates, alcohols etc. Both groups are important in biology as part of amino acids, proteins, cells etc. Plasma polymerized polyallylamine or poly(acrylic acid) is established. These layers are often well-adherent on polyolefin surfaces but their structure is different from that of classic analogues and shows defects, radicals, crosslinking and oxidation. Deposition of polyallylamine plasma polymers onto plasma-brominated polyolefins or graphite may generate the reaction between the amino- and C-Br groups thus producing covalent linking between substrate and polymer layer.To avoid formation of layers with defective structure and irregular composition ultra-thin polymer layers can be deposited by electrospray-ionization (ESI) of solutions of ionic or polar polymers without any polymer degradation or production of structural defects. Macromolecular ions were produced by spraying a polymer solution within a high-voltage field. These macro-ions were discharged at the (grounded) counter electrode, may be electrically conducting graphites or carbon fibres. In such a case the electrophoretic effect of ESI is responsible for self-healing of pin-holes in the deposited ultra-thin polymer layers (<10 nm). Thus, quasi-monomolecular layers of polymers were deposited. The electrophoretic effect makes it possible to coat area shadowed from the spray or to enwrap carbon fibres with polymers pin-hole free within subjacent layers of fibres. ESI in presence of corona plasma activates substrate and coating molecules but produces polymer degradation.
Using non-conducting polymers as substrates spontaneous charging of layer and substrate can be observed. The charged surface produces electrostatic repellence and stops further layer deposition. time. Further deposition or deposition on insulating polymers needs the use of continuous change of current polarity or other methods of charge neutralization.

Keywords
polymer layers
electrospray
electrophoretic effect