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Low-pressure Plasma Fluorination of Polypropylene¹ YANG YANG, Iowa State University, MARK STROBEL, SETH KIRK, HYACINTH CABIBIL, 3M Company, MARK J. KUSHNER, Iowa State University — The surface energy and adhesion properties of commodity polymers such as polypropylene (PP) can be controlled by functionalization of the surface layers in plasmas. Affixing oxygen to the surface of PP, typically by atmospheric pressure coronas, raises surface energy and decreases hydrophobicity. Affixing fluorine lowers surface energy and increases hydrophobicity. In this paper, low-pressure plasma fluorination of PP will be discussed with results from computational and experimental investigations. PP was treated in low pressure (< a few Torr) capacitively coupled plasmas sustained in gas mixtures containing F₂. Process parameters (e.g., power, pressure, flow rate, position of PP in discharge) were varied. The fractional coverage of surface resident groups (CH, CF, CF₂, CF₃) was measured using ESCA. Plasma and surface processes were simulated using a 2-dimensional plasma hydrodynamics and surface chemistry model. The surface reaction mechanism consists of a hierarchy of reactions beginning with H abstraction by F atoms and followed by passivation by F and F₂. Ion (sputtering, scission) and photon (H dissociation, scission) activated processes are included. Comparisons will be made between the model and experiments for surface coverages of CH and CF_n.

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