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In-situ XPS study of low energy argon and oxygen ions etched flexible polymeric substrates

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The flexible electronics requires a flexible substrates with stable properties. Some polymers (PEN, KAPTON, PEEK, PET) can be such substrates. PET foils have a high potential as a material for biomedical applications. Another polymers like POM are light, easy to machine substitution for metal parts in many applications for energy saving. But the polymers usually require certain surface modifications.
The common process before function film or structures deposition, modification is an cleaning process. When the common technique is plasma treatment and magnetron sputtering the cleaning can be processed also by ion etching.
The modification of different polymers by oxygen and argon ions with energy from 0.2keV up to 2keV was investigated in-situ by XPS without any contamination of the treated surface by air before XPS measurements. It simulates the condition used for ion etching before functional film deposition by bias induced ion etching. But here used ion fluxes have only single energy what is not typical for RF self bias on substrates with typical multiple energies due to sheath oscillations.
The argon ion fluxes sputtering of PET is physical sputtering with preferential sputtering of oxygen up to conversion of PET surface to 96% carbon layer with high surface electron conductivity. The oxygen ion flux sputtering is physical and chemical combined process where at low 0.2 keV ion fluxes is dominant chemical process with sputtering yield comparable to 2.5 keV argon ion fluxes. The composition of PET top layer etched by oxygen 0.2 keV ion flux is more rich in oxygen due to removal on carbon containing species. The surface conductivity of such surface is reduced.
FTIR observed increases in absorption on some bands are effects photons in the volume of PET foils. These photons are created in plasma discharge inside ion source. The surface chemical composition can be modified by selected ion bombardment in wide range from 96% of carbon up to oxygen rich top layer surface.

Keywords
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