

Superior functional plasma coating from protonated precursor ions via the plasma α - γ transition

Solmaz Saboohi¹, Bryan R Coad¹, Hans J Griesser¹, Andrew Michelmore^{1,2} and Robert D Short^{1,3}

¹Future Industries Institute - University of South Australia, Australia

²University of South Australia, Australia

³University of Lancaster, UK

Chemically functionalized surfaces may be produced via plasma polymerization; however, a high degree of functional group retention is often difficult to achieve. Here, the plasma polymerization of three structurally related ester precursors, ethyl isobutyrate (EIB), methyl isobutyrate (MIB) and ethyl trimethylacetate (ETMA) is compared at low and high pressure. In moving from a low pressure to higher

pressure regime, significant changes in the plasma chemistry and resulting plasma polymer deposit were observed with much higher retention of chemical functionality at the higher pressure observed. Until now these changes would have been attributed to a decrease in the energy/molecule, however we show by direct measurement of the chemistry and physics of the plasma that there is fundamental shift in the properties of the plasma and surface interactions which explain the results. At low pressure (α regime) precursor fragmentation and neutral deposition dominate resulting in poor functional group retention. Increasing the pressure such that the sheath region close to surfaces becomes collisional (γ regime) favours production of protonated precursor ions which retain functionality and dominate the deposition process rather than radical species.

Solmaz.Saboohi@unisa.edu.au