

PO4057

Plasma-enhanced ALD: a route to hydrophilic, glueable PTFE

Geert Rampelberg, Amit Roy, Jolien Dendooven, Davy Deduytsche, Kilian Devloo-Casier, Kim Ragaert, Ludwig Cardon, Christophe Detavernier

Ghent University, Gent, Belgium

geert.rampelberg@ugent.be

Due to its excellent chemical stability and anti-adhesion properties, polytetrafluoroethylene (PTFE) commercially, known as “Teflon”, is of great interest in a wide range of scientific and industrial areas including micro-electronics, biomedicine, fuel cells, and protective coatings. However, this same lack of reactivity makes it challenging to functionalize the PTFE surface or establish a stable bonding with other materials, thus limiting the use of PTFE in certain applications.

Over the past decades, plasma treatment of PTFE has been intensively investigated for inducing a hydrophilic surface effect and improving the interfacial adhesion strength. A serious problem of this technique is however the aging of the surface modification upon environmental exposure.

In our recent work [1], we reported the successful synthesis of stable hydrophilic and “glueable” PTFE surfaces via plasma-enhanced (PE-)ALD of Al_2O_3 . We showed that alternating exposures of PTFE to oxygen plasma and TMA resulted in an Al_2O_3 coating firmly attached to the PTFE substrate. The PE-ALD deposited Al_2O_3 coatings remained intact after the Scotch tape test while the thermal ALD layers did not pass the adhesion test. A pure oxygen plasma treatment resulted in an enhanced hydrophobicity. In contrast, when the oxygen plasma pulses were alternated with TMA exposures, a controllable and permanent hydrophilic effect was induced. Furthermore, evaluation of the “glueability” of PTFE to aluminum metal revealed a more than 10-fold increase in adhesion strength for PE-ALD modified PTFE sheets compared to native samples.

[1] A. K. Roy, J. Dendooven, D. Deduytsche, K. Devloo-Casier, K. Ragaert, L. Cardon and C. Detavernier, Chem. Comm., 2015, DOI: 10.1039/C4CC09474C.

Keywords

plasma

ALD

Teflon

PTFE