Molecular layer deposition of polymeric films

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Molecular Layer Deposition (MLD) is the term used when polymeric materials are deposited by ALD. It has been much less extensively studied than ALD and only a small number of organic materials have been studied but the process has the potential to produce an enormous variety of materials. In principle, MLD behaves similarly to ALD but the greater size of the molecules and the relative instability of some of the polymers means that in many cases there is no “ALD window” where the deposition rate is independent of temperature. Typically, the deposition rates reduce with temperature. However, at a given temperature, saturation behaviour is observed as shown in figure 1 for the case of polyethylene terephtalate (PET) films.

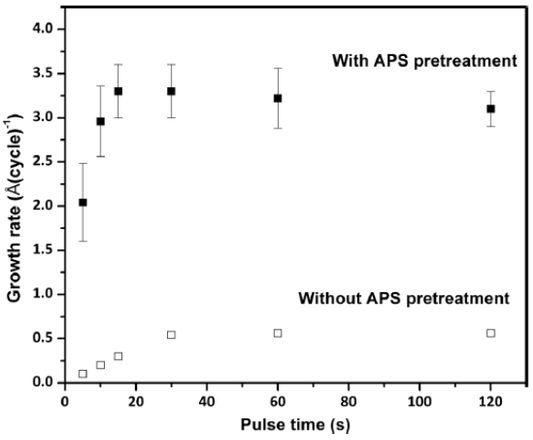

Fig.1 Saturation curve for PET film growth[11]

Other issues arise because of the length of the polymer molecules which should be anchored to the substrate at one end as the film grows and align themselves more or less vertically. These long molecules may bend back towards the substrate and become attached at both ends leading to non-uniform growth.

A review of the materials which have been deposited by MLD and the types of reaction which occur will be given.

[1] T. V. Ivanova, P. S. Maydannik and D. C. Cameron, J. Vac. Sci. Technol. A 30 (2012) 01A121