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Observing the synthesis of a polymer brush, molecule by molecule

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Densely surface-grafted polymers have attracted considerable attention due to the desirable interfacial properties that stem from both their conformation and anchored liquid-like state. To create these surfaces with desirable thicknesses and grafting densities a grafting-from approach, wherein polymers are grown from surface-attached initiators, must be used to assemble the layer. The most widely used polymerisation method for grafting-from approaches is Atom Transfer Radical Polymerisation (ATRP), due to its simplicity and versatility. The structure of such a layer is understood to modulate interactions between the coated surface and its local environment, including changes to lubrication, adhesion or fouling by contaminants. As such, understanding the structure of these polymer layers (including the molecular weight distribution of the substituent chains) is essential.

Prior neutron reflectometry (NR) work indicates the presence of a dense layer adjacent to the substrate, at the base of the brush. Gel permeation chromatography (GPC) studies and simulations of the ATRP process indicate that this layer consists of stunted polymer chains proximal to the surface. The alternative explanation that has been proposed is that this dense layer is made up on initiator moieties.

Here we observe the growth of a surface-initiated polymerisation *in situ* with NR; to our knowledge, this is the first time such an experiment has been performed. We show that the interior layer previously observed by NR is not due to a thick initiator layer, but rather a dense polymer layer that is formed during the initial stages of the polymerisation. This experiment paves the way for further kinetic experiments on *PLATYPUS* that seek to study the dynamic assembly of interfaces over timescales of 10 minutes to multiple hours.

Speakers Gender

Male

Level of Expertise

Student

Do you wish to take part in the poster slam

Yes

Primary author(s) : GRESHAM, Isaac (The University of New South Wales)

Co-author(s) : Mr JOHNSON, Edwin (University of Newcastle); NELSON, Andrew (ANSTO); PRESCOTT, Stuart (UNSW Chemical Engineering)

Presenter(s) : GRESHAM, Isaac (The University of New South Wales)

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