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Surface-confined polymerisation: synthetic chemistry without a beaker

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One of the most intriguing ideas of the last decade is the concept of translating well-known chemical synthesis methods into the realm of surface science. The ability to interrogate individual atoms and molecules by scanning probe microscopies affords new insights into well-established reaction pathways, and in some cases can reveal unexpected and often surprising new structures. Synthesis of polymers via on-surface arene coupling is an intriguing and facile route towards novel 1D and 2D materials. Ullmann coupling has been the most studied of these methodologies, as it offers a convenient and simple way to control the growth of the polymer products by employing the substrate both as the catalyst for initiating the coupling reaction, as well as a template for supporting the product and driving its growth into well-ordered domains.[1]

In this seminar I will describe our longstanding interest in molecular reactions with the aim of producing new interesting and functional materials, such as simple polyphenylenes,[1] industrially-relevant thiophenes,[2,3] and exotic two-dimensional analogues of graphene. [4,5] I will briefly touch on strategies to avoid the chief perceived drawback of Ullmann coupling: that it is not considered to be a 'clean' reaction because most surfaces host both the polymer product and the halogen byproducts, the latter of which block catalytic sites on the surface and ultimately act to limit the yield of the product.

References

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