Dynamic chemistry on and with graphene

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Chemistry of graphene has been mostly regarded as one of the methods that can modify and tune graphene properties. The advance of smart graphene devices has shown that the flexibility of chemical functionalization with any molecule of choice is not enough and one must control not only *what*, but also *where* and *when* the bond is formed. Two approaches to this target have been investigated. Laser-induced periodic surface structures have been created on the Si/SiO_2 substrate and graphene transferred onto it then exhibits periodic doping levels, which translates into different reactivity and ultimately in periodic functionalization density on graphene.[1] In the second approach, coupled reaction network was modulated by UV irradiation through a mask to create a pattern of functionalized and pristine graphene.[2] Reaction networks on graphene couple dynamic physisorption and dynamic bonding to drive the formation of conjugated imine polymers.[3] The dynamic equilibrium of this reaction network can be tipped from linear polymers to isolated oligomers or, in the intermediate area, to the formation of large pore-size macrocycles on the surface.[4] Finally, the dynamic bonding can be exploited for out-of-equilibrium manipulation with nanoscale objects on graphene and thus controlled nanoparticle motion followed in real-time.[5] In summary, chemistry of graphene has much more to offer than a simple properties change and when dynamic reaction networks are employed, new fascinating opportunities emerge (Figure 1).

References

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Figures

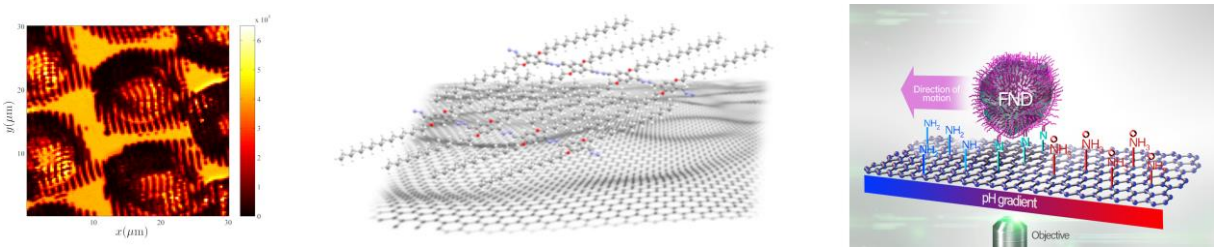

Figure 1: Principles of dynamic chemistry and reaction networks have been employed to achieve (from left to right) spatially resolved functionalization of graphene, formation of conjugated polymers and macrocycles and directional motion of nanoparticles on graphene surface.