Measuring Interfacial Kinetics and Stability of Thin Films Using Quartz Crystal Microbalance

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Interactions of biomolecules with functional coatings have been studied over the last decade for various applications in sensors and controlled release drugs. The need for monitoring in situ and real time kinetics of molecular level interactions is apparent for these applications. Nano-gravimetric technique that utilizes quartz crystal microbalance (QCM) is one such method with a mass resolution up to one nanogram. QCM studies were carried out to monitor the stability of thin coatings of nano-hydroxyapatite (HA-Np), and graphene oxide (GO), which are functional coatings considered for many advanced sensor applications. Further, kinetics of molecular interaction at the above respective interfaces elucidate on the mechanistic details of molecular adsorption and desorption in relation to surface morphology, available functional groups and their type, and environmental conditions. Our findings on hygroscopic properties of GO and it derivatives provide an insight to the contribution of surface oxygen functional groups towards the water adsorption rate and the amount adsorbed. Also it provides important information that can be used during GO-based sensor design and calibration. Moreover, studies on interactions of biomolecules with morphologically different HA-Np have paved a path for applications in controlled release drugs and fertilizers.

Key words: Quartz crystal microbalance, Kinetics, Stability, Hydroxyapatite, Graphene oxide

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