Mechanistic Insight to Water Adsorption on Graphene Oxide

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The surface of graphene oxide (GO) is rich with different oxygen functional groups. This has made GO a material of choice for many sensing applications, including humidity sensing. However, limited research is available that describes the exact mechanism at the interface of GO in its response to humidity. This requires a systematic kinetic study of water adsorption at GO interface. In this presentation we report the fitting of experimental kinetic data obtained using in situ quartz crystal microbalance (QCM) that describe the mechanistic details of water-GO interaction. The fitting of experimental adsorption data were done with four different hyperbolic models; Langmuir model, Diffusion controlled Langmuir model, Emperical hill model and Two-step process kinetic model where the later providing the best fit. The two-step process kinetic model consists of two parts where the first part corresponds to the adsorption of water molecules to the graphene oxide surface and the second part corresponds to water adsorption through rearrangement of graphene oxide with an interlayer expansion. At lower relative humidity values, the interlayer adsorption becomes negligible and makes the process behave similar to the Langmuir kinetic model. Further the Gibbs free energy calculated from the kinetic results confirms an interface physisorption of water to GO.

Key words: Kinetic models, Adsorption, Graphene oxide, Relative humidity, Quartz crystal microbalance

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