Studies of Isocyanate oligomer mixed with Graphene Oxide

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Polymer composites have been used in the last decades in order to improve mechanical, thermal, electrical and gas barrier properties[3]. With the discovery of graphene, a new area of research has been established by mixing graphene with different polymers in order to create graphene-based polymer composite materials. Herein, we present a study of different composites based on Graphene oxide (GO) and the basic components of polyurethane (PU). It is essential to understand and study at nanoscale level the interactions that take place between graphene and polymers in order to develop and improve new composite materials where the exceptional properties of graphene are transferred from single sheet scale to bulk material properties.

For this reason, in this study we will show how the basic components of PU can react when they are deposited on different substrates where ultra-thin layers of GO were deposited before. We know that Polyurethane is produced when Isocyanate and polyols are chemically reacting together. By replacing water with GO (which already contains water) should have some interesting properties. The study of the interactions between these two components was studied at the nanoscale by using scanning probe microscopy. The first preliminary results show that the Isocyanate oligomer in very low concentrations is adsorbed preferably on the GO sheets and seems to polymerize on them. In order to understand if this is real, a series of experiments with GO and Isocyanate solutions in different concentrations has been made. By examining the solutions we found that when GO is mixed with Isocyanate (dissolved in Toluene) an emulsion is created that could be stable for many weeks. This was explained because GO can act as an emulsifier and create sub-millimiter-sized organic solvent droplets (toluene) that can be stable[4]. The size of the toluene droplets was found to depend on the concentration of GO in water. Moreover, when we changed the concentration of GO, it was noticed that GO was acting as an amphiphile and GO's amphiphilicity can be tuned by pH[2].

References

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