Polydopamine Assisted Mechanically Reinforcement of Graphene Oxide Fiber from Graphene Oxide Liquid Crystals

Hyun-Tae Hwang[(1)]
Hyeon Suk Shin[(1),(2),*]

[(1)]*Department of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology , 50, UNIST-gil, Eonyang-eup, Ulju-gun, Ulsan, KOREA*
[(2)]*Department of Chemistry, Ulsan National Institute of Science and Technology , 50, UNIST-gil, Eonyang-eup, Ulju-gun, Ulsan, KOREA*

*Shin@unist.ac.kr

In recent years, Graphene fiber, one of the carbonaceous fiber, has attracted attention from many researchers because of their distinguished properties of graphene such as flexibility, mechanical properties and electrical and thermal conductivity[1],[2]. Although graphene fiber is interesting material, it is hard to apply to real application including strain sensor, fiber type actuators and electronic conducting fiber. Because, Graphene fiber is mechanically weaker than other carbonaceous fiber such as conventional carbon fiber and carbon nanotube fiber. However, many researchers want to fabricate the graphene with high mechanical properties due to characteristic graphene fiber such as more flexible and cheaper than carbon and CNT fiber. In this study, we fabricate mechanically reinforced graphene oxide fiber using dopamine hydrochloride(DA) coagulation bath from graphene oxide liquid crystals. After then, graphene oxide fiber derived by DA was soaked into pH 8.5 Tris-HCl buffer solution and reacted three hours to preparing polydopamine functionalized graphene oxide fiber. The pH-induced polydopamine functionalization is inspired by robust adhesion of marine mussels[3]. From this reason, the polydopamine functionalized graphene oxide fiber shows enhanced tensile strength then previous graphene oxide fiber (derived by $CaCl_2$ coagulation bath). Moreover, the polydopamine functionalized graphene fiber was reduced by microwave treatment, this method was previously reported to obtain high quality graphene from graphene fiber[4], to obtain nitrogen doped high quality graphene fiber. The microwave-reduced polydopamine functionalized graphene oxide shows improved electrochemical performance and we expect that it can apply to various application.

References

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Figures

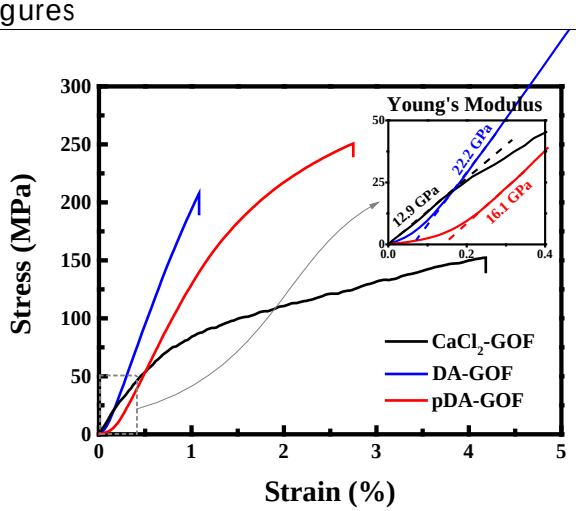

Figure 1: Mechanical properties of $CaCl_2$, DA coagulated and polymerized DA coagulated graphene oxide fiber.