Synthesis of a Dibromomaleimide Functionalized Polymer Gel-Coated Single Walled Carbon Nanotubes

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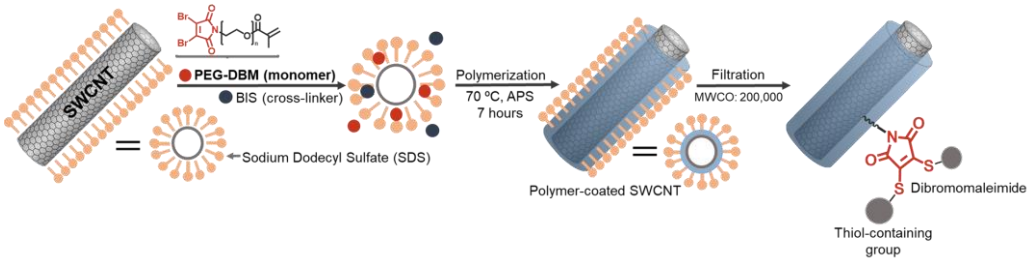
Single-walled carbon nanotubes (SWCNTs) are a promising nanomaterial especially for bio-applications such as imaging because of its strong absorbance and emission in the NIR region where the body is transparent. However, SWCNTs lack the dispersibility in aqueous solutions as well as the selectivity for use in such bio-applications. To overcome these issues, the conventional method is to covalently modify SWCNTs with functional molecules, which often causes it to lose its NIR optical properties.

Given this, we have previously reported a method to preserve the NIR properties of SWCNTs whilst maintaining its stable dispersion in aqueous solutions called CNT micelle polymerization.[1] With this method, SWCNTs are first dispersed in an aqueous solution containing sodium dodecyl sulfate (SDS) surfactants, after which the desired monomer and cross-linker is added into the solution. Polymerization is then performed at 70 °C with ammonium persulfate (APS) for 7 hours, which yields a cross-linked polymer coating on the SWCNTs underneath the surfactant micelles, maintaining the stable dispersion of the SWCNTs upon the removal of SDS through filtration. In our previous work, we have demonstrated the introduction of sites for post-modification onto the polymer by using a monomer containing the maleimide functional group.[2]

In this report, a new monomer containing dibromomaleimide (DBM) was incorporated as the post-modification sites based on CNT micelle polymerization. DBM has advantage over maleimide for the attachment of disulfides, which could allow for the conjugation of antibodies without the need for fragmentation.[3] The resulting polymer nanotubes show stable dispersion in aqueous systems, as well as strong NIR absorbance and photoluminescence emission. The DBM-modified SWCNTs were then subject to post-functionalization conjugation.



1) T. Fujigaya et al., N. Nakashima, *RSC Adv.* **2014**, *4*, 6318. 2) Y. Nagai et al., *J. Am. Chem. Soc.* **2018**, *140*, 8544. 3) M. E. B. Smith et al., *J. Am. Chem. Soc.* **2010**, 132, *6*, 1960.