Self-Assembled Vesicles of Emissive Surfactants in Water: Structural Characterization and Photophysical Insights

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Controlling the emission color of organic compounds is an important strategy for applications such as OLEDs. Intermolecular orientation plays a crucial role in determining the emission properties. In the crystalline state, emissive behavior is governed by intermolecular interactions, mainly originating from π-electron interactions of chromophores; consequently, molecular orientations are restricted to the most stable configurations, resulting in limited structural diversity.
In contrast, molecular assemblies in aqueous media can exhibit diverse supramolecular structures arising from complex intermolecular interactions. Hydrophobic interactions play a central role in the self-assembly of amphiphiles into micelles and vesicles, driven by the entropic stabilization of water molecules. Therefore, self-assembly in aqueous solutions is expected to produce molecular orientations and emission behaviors that are not accessible in the crystalline state[1].
In this study, we synthesized new emissive amphiphiles bearing an aminostilbazolium skeleton and two hydrophobic alkyl chains. Aminostilbazolium derivatives exhibit distinct emission color changes depending on their local environment due to their charge-transfer character, suggesting the possibility of substantial color tuning through control of molecular orientation.
These molecules formed vesicle-like structures in aqueous solution (TEM image shown in Figure 1). The particle size and bilayer structure were characterized by DLS and SAXS. Considering the electrostatic interactions between neighboring molecules, bilayer structures are not typically formed by conventional dyes under crystalline conditions. Finally, distinct emission behaviors were observed in highly diluted solution, vesicular assemblies, and the neat state.

Keywords:
self-assembly, vesicle, SAXS, Fluorescence

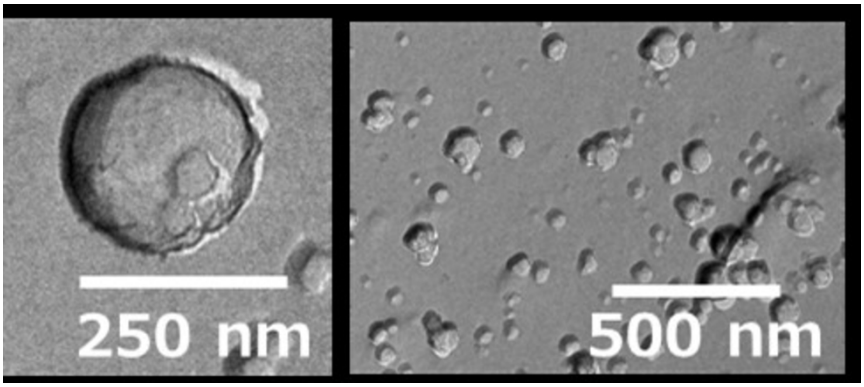

Figure 1. TEM images for self-assembly of the amphiphilic Aminostilbazolium derivatives.

References:

[1] K. Arakawa, et al., J. Phys. Chem. B 2025 , 129 , 50 , 12988−12996.