Remarkably stable gold nanoparticles functionalized with zwitterionic liquid based on imidazolium-sulfonate in high concentration of aqueous electrolyte and ionic liquid

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A new disulfide 1 was synthesized by general methods as illustrated in Scheme 1. Imidazole was treated with sodium hydride in THF to form the anion which was reacted with Br-(CH₂)₁₀-S-S-(CH₂)₁₀-Br to yield 2. Zwitter-disulfide 1 was prepared in 88% yield by reaction of 2 with 1,3-propanesultone in acetone at room temperature for 5 days. 1: FT-IR 1652 cm⁻¹ (C=C), 1190 and 1043 cm⁻¹ (SO₂); ¹H NMR (DMSO-d₆) δ 9.19 (s, 2H, NCHN), 7.80-7.76 (m, 4H, NCHCHN), 4.30 (t, 4H, J = 7 Hz, NCH₂), 4.14 (t, 4H, J = 7 Hz, NCH₂), 2.67 (t, 4H, J = 7 Hz, CH₂SO₃), 2.41 (t, 4H, J = 7 Hz, CH₂S), 2.09 (q, 4H, J = 7 Hz, CH₂), 1.77 (q, 4H, J = 7 Hz, CH₂), 1.58 (q, 4H, J = 7 Hz, CH₂) and 1.34-1.23 (m, 24H, CH₂); ¹³C NMR (DMSO-d₆) δ 136.0, 122.3, 122.2, 48.7, 47.8, 47.3, 37.8, 29.3, 28.8, 28.7, 28.5, 28.3, 27.7, 26.2, 25.5. MS (FAB), m/z 723 (MH⁺).

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\begin{align*}
\text{i, NaH, THF, room temp.}, & \quad 1 \text{ h;} \\
\text{ii, Br-(CH₂)₁₀-S-S-(CH₂)₁₀-Br;} \\
\text{iii, acetone, room temp.}
\end{align*}
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