

Array of bis-quaternary ammonium surfactants tailored $\text{Cu}_{(2-x)}\text{Te}$ quantum dots with amended functional assets

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Table 1. Average particle sizes, as determined by XRD of (12-2-12), (14-2-14) and (16-2-16) capped copper telluride nanoparticles.

NPs	2θ (degree)	FWHM	Average Particle size (nm)
(12-2-12) + $\text{Cu}_{(2-x)}\text{Te}$	36.51	0.60	15.24
	43.45	0.28	
	50.58	0.80	
	61.63	0.86	
	73.77	0.97	
(14-2-14) + $\text{Cu}_{(2-x)}\text{Te}$	26.78	0.19	28.76
	36.51	0.52	
	43.45	0.46	
	50.58	0.25	
	61.63	0.24	
(16-2-16) + $\text{Cu}_{(2-x)}\text{Te}$	36.51	0.45	34.69
	43.45	0.37	
	50.58	0.23	
	61.63	0.19	
	73.77	0.22	

Table 2. Peak assignment of different bis-quaternary ammonium surfactants in the absence and presence of $\text{Cu}_{(2-x)}\text{Te}$ nanoparticles.

Peak assignment	(12-2-12)	(12-2-12)- $\text{Cu}_{(2-x)}\text{Te}$	(14-2-14)	(14-2-14)- $\text{Cu}_{(2-x)}\text{Te}$	(16-2-16)	(16-2-16)- $\text{Cu}_{(2-x)}\text{Te}$
ν_{asym} (C-H)	2959	2953	2959	2919	2959	2919
	2925	2921	2922	---	2922	---
ν_{sym} (C-H)	2858	2851	2854	2848	2854	2848
δ_{s} (C-H)	1469	1454	1469	1463	1469	1463
ν (C-N ⁺)	1160	---	1160	---	1160	---

1056	1015	1015	1046	1042	---
974	840	840	833	972	844

Table 3. Geometric parameters of Cu_(2-x)Te nanoparticles with different bis-quaternary ammonium surfactants.

NPs	Scherrer Method	Williamson-Hall Method											Size-Strain Plot	TEM			
		UDM			USDM			UEDM									
		Size, <i>D</i> (nm)	Strain, ϵ T	Strain, ϵ C	Size, <i>D</i> (nm)	Strain, ϵ T	Strain, ϵ C	Stress, σ (MPa)	Size <i>D</i> (nm)	Strain, ϵ (Tensile Only)	Stress, σ (MPa)	Energy Density, <i>u</i> (KJm ⁻³)			Size <i>D</i> (nm)	Strain (ϵ) (Tensile Only)	Stress, σ (MPa)
Cu _(2-x) Te- (12-2-12)	15.24	9.2	NA	-4.0 & -6.5 x10 ⁻³	13	1.818	-2.318	209.80	51	1.76 x10 ⁻²	38.33	6.37	81	3.984	458.16	912.65	25 ±10.8
Cu _(2-x) Te- (14-2-14)	28.76	11.9	9.5 x10 ⁻³	-4.3 x10 ⁻⁴	12.8	1.2	-4.6896 x10 ⁻³	160.89	81	1.66 x10 ⁻²	50.38	81.03	73	-0.300 (C)	165.49	119.88	45 ±18.7
Cu _(2-x) Te- (16-2-16)	34.69	90.5	3.8x 10 ⁻³	-1.52 x10 ⁻²	85.5	4.450	-0.0017	511.7	50.6	1.55 x10 ⁻²	9.69	0.42	85.5	5.44 x10 ⁻¹	62.56	17.02	130 ±31.6