

Supplementary Information

for

Robust, Processible, and Bright Quantum Dot/Organosilicate Hybrid Films with Uniform QD Distribution Based on Thiol-Containing Organosilicate Ligands

Heeje Woo,^a Jaehoon Lim,^a Yeonju Lee,^a Jinwoo Sung,^b Hyunkwon Shin,^b Jin Mok Oh,^b
Moongoo Choi,^b Hyunsik Yoon,^c Wan Ki Bae,^d and Kookheon Char^{*,a}

^aThe National Creative Research Initiative Center for Intelligent Hybrids

The WCU Program of Chemical Convergence for Energy & Environment

School of Chemical & Biological Engineering

Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 151-744, Korea

^bMaterials and Devices Laboratory, LGE Advanced Research Institute, LG Electronics

38, Baumoe-ro, Seocho-gu, Seoul 137-724, Korea

^cDepartment of Chemical Engineering, Seoul National University of Science & Technology

Seoul, 139-743, Korea

^dChemistry Division, Los Alamos National Laboratory, Los Alamos, NM 87544, US

S1. FT-IR Analysis of TM37 and TMP371

TM37 and TMP371 showed almost same FT-IR spectra. In FT-IR spectra, O-H stretching peaks at $\sim 3400\text{ cm}^{-1}$, Si-OH stretching peaks at $\sim 890\text{ cm}^{-1}$, and cross-linked Si-O-Si stretching peaks at $\sim 1045\text{ cm}^{-1}$ are appeared without caged Si-O-Si stretching peak which appears at $\sim 1130\text{ cm}^{-1}$.

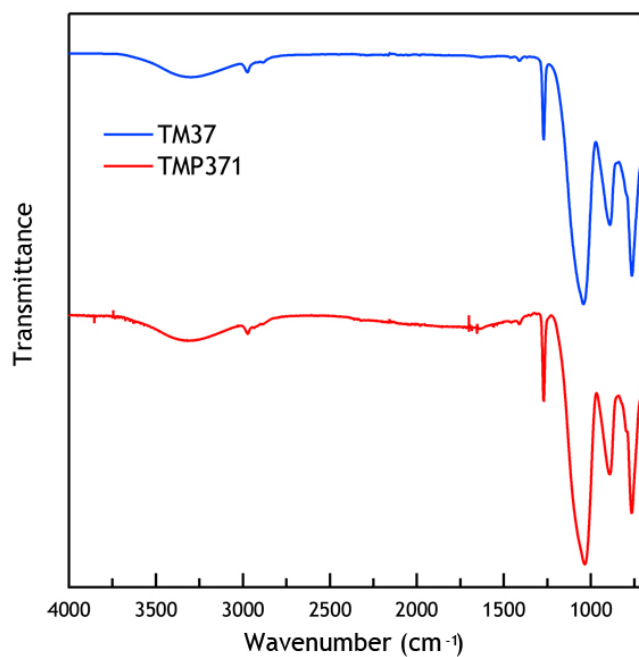


Fig. S1 FT-IR spectra of TM37 and TMP371.

S2. $^1\text{H-NMR}$ Analysis of TM37 and TMP371

$^1\text{H-NMR}$ spectra of TM37 and TMP 371 showed strong Si- CH_3 peaks at ~ 0.15 ppm, weak and broad Si- OH peaks at ~ 5.72 ppm, and residual methoxy (Si-O- CH_3) and ethoxy (Si-O- CH_2CH_3) peaks at 3.3-3.9 & 1.1-1.4 ppm in common. In the case of TMP371, additional peaks from propyl thiol moieties in MPTMS were detected at ~ 0.80 ppm (Si- $\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$), ~ 1.64 ppm (Si- $\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$), and ~ 2.58 ppm (Si- $\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$). Through the integration of the peaks, the incorporation ratio of MTMS and MPTMS in TMP371 was calculated as follows.

- MTMS : MPTMS = 7.67 : 1

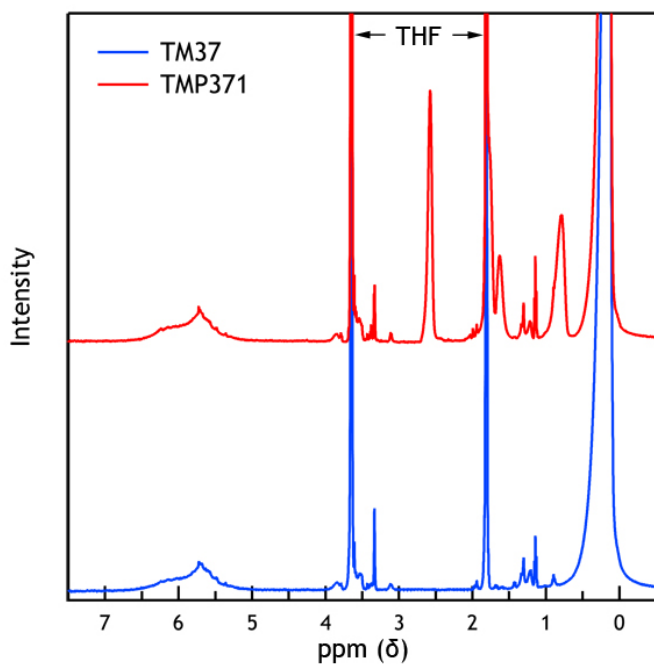


Fig. S2 $^1\text{H-NMR}$ spectra of TM37 and TMP371.

S3. Solid ^{29}Si -NMR Analysis of TM37 and TMP371

The incorporation ratios of OS precursors in TM37 and TMP371 were thoroughly calculated by Solid ^{29}Si -NMR analysis. The solid ^{29}Si -NMR spectra of the both OS polymers and peak information were presented in Fig. S3 and Table S3. Through the integration of the peaks, the incorporation ratios of OS precursors in TM37 and TMP371 were calculated as follows.

1) TM37 - TEOS : MTMS = 2.17 : 7

2) TMP371 - TEOS : (MTMS+MPTMS) = 2.53 : 8

Using the results of ^1H -NMR and solid ^{29}Si -NMR, the incorporation ratio of three OS precursors in TMP 371 was calculated as follows.

- TEOS : MTMS : MPTMS = 2.74 : 7.67 : 1

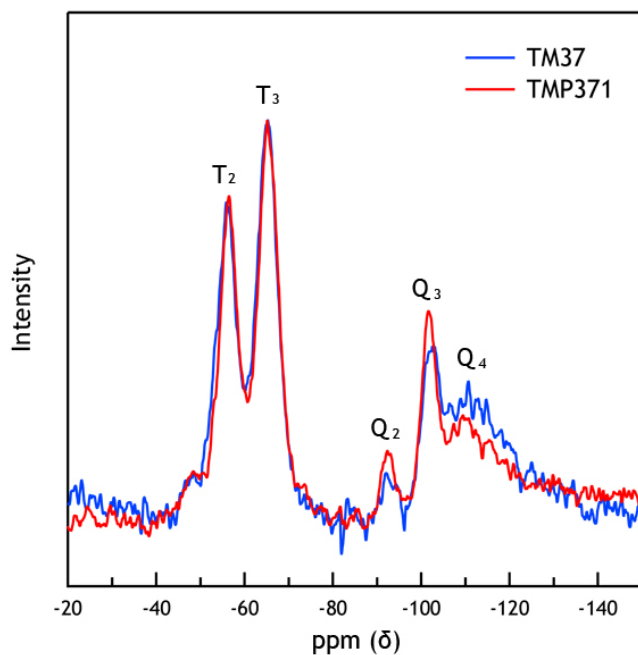


Fig. S3 Solid ^{29}Si -NMR spectra of TM37 and TMP371.

Table S3 Peak information for Solid ^{29}Si -NMR spectra

Peak	T ₂	T ₃	Q ₂	Q ₃	Q ₄
Molecular Structure	$\text{CSi}(\text{OSi})_2\text{OH}$	$\text{CSi}(\text{OSi})_3$	$\text{Si}(\text{OSi})_2(\text{OH})_2$	$\text{Si}(\text{OSi})_3(\text{OH})$	$\text{Si}(\text{OSi})_4$
Monomers	MTMS, MPTMS	MTMS, MPTMS	TEOS	TEOS	TEOS

S4. MALDI-TOF Analysis of TM37 and TMP371

The molecular weight and polydispersity index of TM37 and TMP371 were measured by MALDI-TOF.

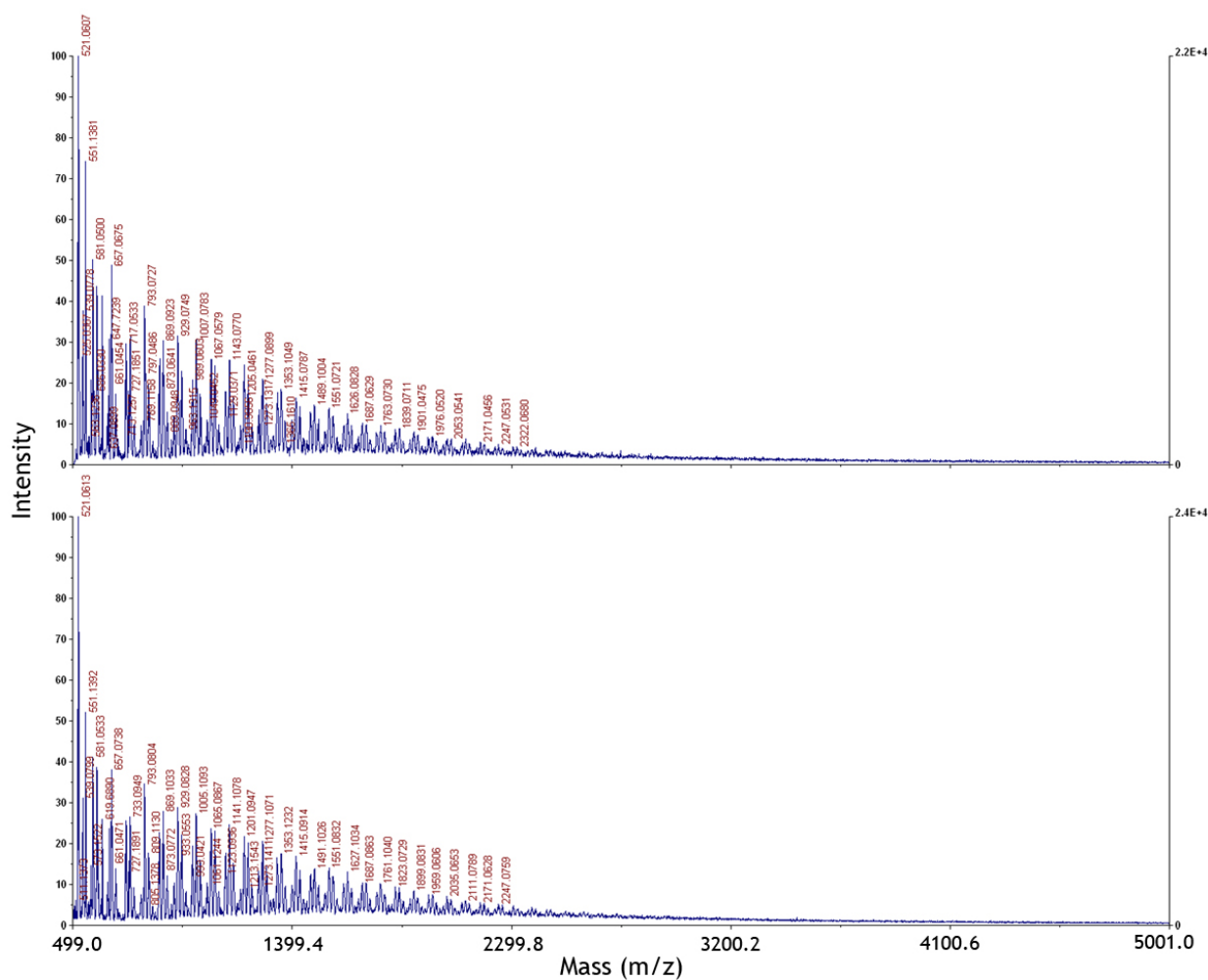


Fig. S4 MALDI-TOF spectra of TM37 (top) and TMP371 (bottom).

Table S4 The molecular weight and polydispersity index (PDI) of TM37 and TMP371

	M_n	M_z	M_w	PDI
TM37	1339.02	1618.57	1486.95	1.11
TMP371	1290.32	1611.77	1467.02	1.14

S5. Chromaticity Coordinates and Color Temperature of QD/TMP Hybrid Films

The chromaticity coordinates of red, green, blue, and white QD/TMP hybrid films were characterized using Commission Internationale de l'Eclairage (CIE) chromaticity diagram. The color temperature of white QD/TMP hybrid film is 6,280 K.

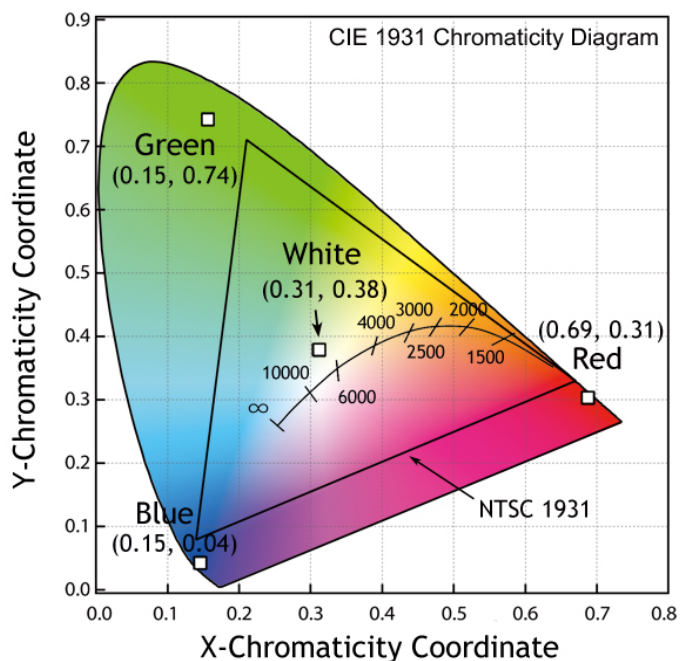


Fig. S5 The chromaticity coordinates of red, green, blue, and white QD/TMP hybrid films.