Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Material & Fabrication method

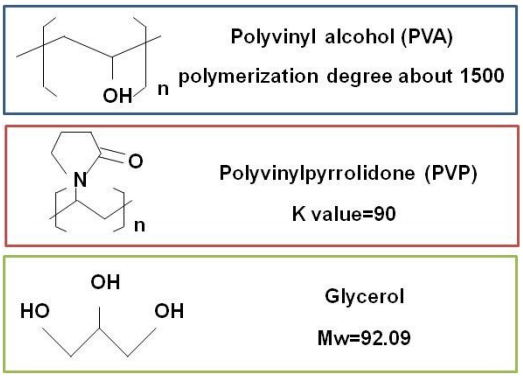

Fig S1. Viscous Materials

Viscosity of PVA and PVP at 20 °C was measured by conventional rotational viscometer. Viscosity data at 20 °C of glycerol was cited from Miyoshi oil & fat co., ltd.

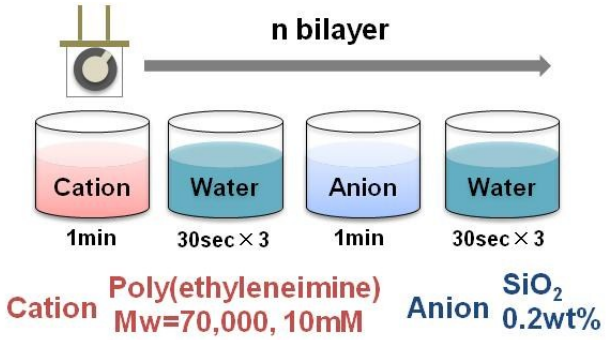

Fig S2. Layer by Layer (LbL) self assembly method of PEI and SiO_2

A thin hydrophilic film was fabricated using a wet process by alternately depositing the QCM substrate in cationic solution for 60sec, pure water for 30sec × 3times, anionic solutions for 60sec and pure water for 30sec × 3times.

Hydrophilic coating

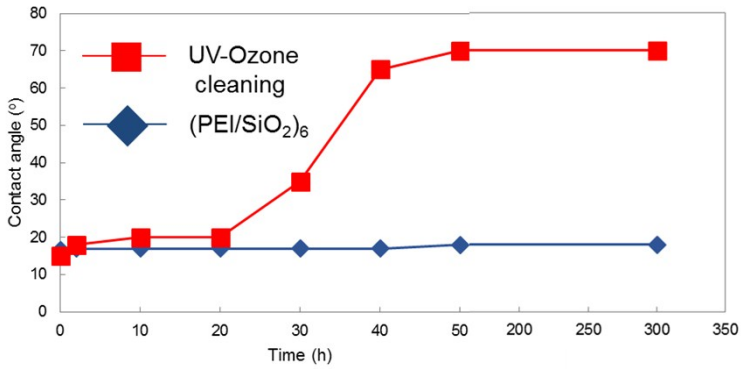

Fig S3. Hydrophilic treatments

Compared with UV-ozone treatment, $(PEI/SiO_2)_6$ hydrophilic coating fabricated by LbL method had long-term hydrophilicity.

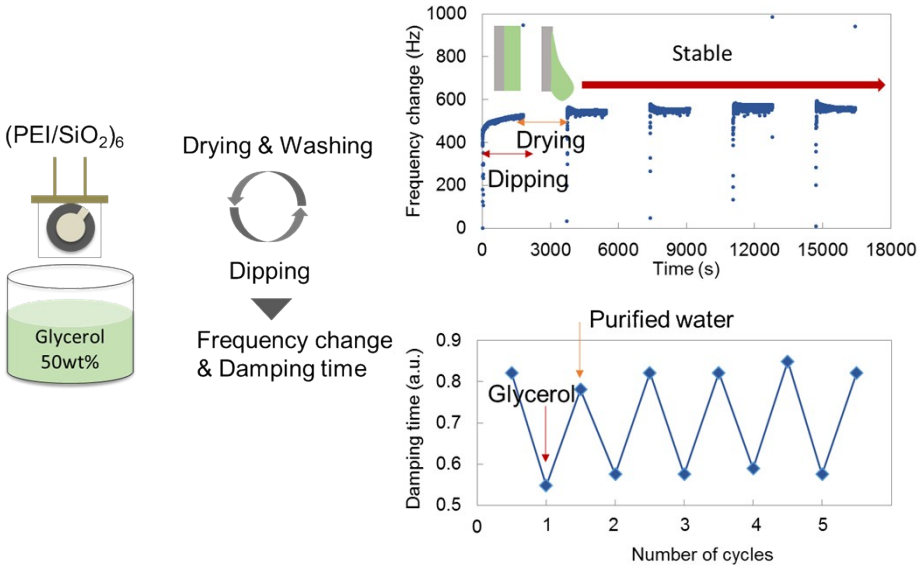

Fig S4. Repeatability of frequency change and damping time with using $(PEI/SiO_2)_6$ hydrophilic coated QCM

We measured the repeatability of frequency change and damping time of $(PEI/SiO_2)_6$ coated QCM in glycerol solutions. Although it was difficult to remove viscous solution in drying process due to hydrophilicity and it had abnormal frequency, the frequency was stable in dipping condition. In addition, we were able to observe repeatable damping time measurement in glycerol solution and purified water with using $(PEI/SiO_2)_6$ hydrophilic coated QCM.

QCM-D

Table S1. Damping time measurement (a.u.) of glycerol, PVA and PVP with using the bare or hydrophilic QCM

(a)

Bare QCM / Glycerol(aq) 30μl		
Concentration(wt%)	Damping time	
	Measured (ms)	Relative
-	73.0	1.000
0	62.0	0.849
20	60.3	0.826
30	55.0	0.753
40	51.6	0.707
50	40.0	0.547
60	23.3	0.319

(b)

Hydrophilic QCM / Glycerol(aq) 5μl		
Concentration(wt%)	Damping time	
	Measured value (ms)	Relative
-	73.0	1.000
0	62.3	0.853
20	58.3	0.799
30	54.6	0.748
40	51.0	0.698
50	38.3	0.525
60	20.0	0.274

(c)

Bare QCM / PVA(aq) 30μl		
Concentration(wt%)	Damping time	
	Measured value (ms)	Relative
-	73.0	1.000
0	65.0	0.890
5	60.0	0.822
7.5	56.7	0.776
10	50.7	0.694
12.5	41.7	0.571
15	27.0	0.370

(d)

Hydrophilic QCM / PVA(aq) 5μl		
Concentration(wt%)	Damping time	
	Measured value (ms)	Relative
-	73.0	1.000
0	62.3	0.853
5	62.0	0.849
7.5	55.0	0.753
10	50.3	0.689
12.5	41.3	0.566
15	24.0	0.329

(e)

Bare QCM / PVP(aq) 30μl		
Concentration(wt%)	Damping time	
	Measured value (ms)	Relative
-	73.0	1.000
0	65.0	0.890
5	58.7	0.804
10	54.0	0.740
15	50.7	0.694
20	43.7	0.598
25	22.7	0.311

(f)

Hydrophilic QCM / PVP(aq) 5μl		
Concentration(wt%)	Damping time	
	Measured value (ms)	Relative
-	73.0	1.000
0	62.3	0.854
5	63.0	0.863
10	57.0	0.781
15	50.0	0.685
20	37.5	0.514
25	25.0	0.342

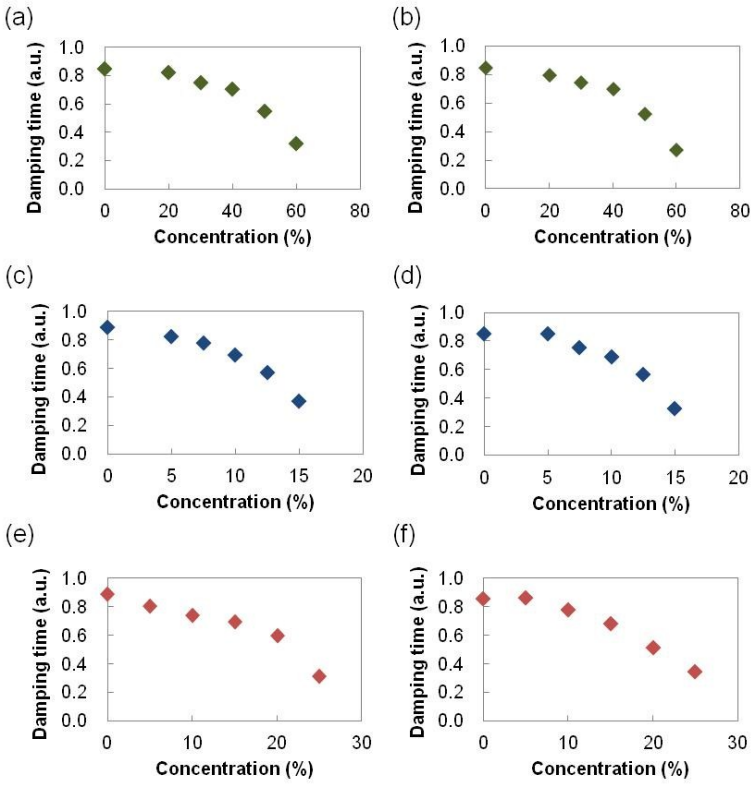

Fig S5. The relationship between damping time and concentration

(a) glycerol with bare QCM-D, (b) glycerol with hydrophilic QCM-D, (c) PVA with bare QCM-D, (d) PVA with hydrophilic QCM-D, (e) PVP with bare QCM-D and (f) PVP with hydrophilic QCM-D.