

Supporting information

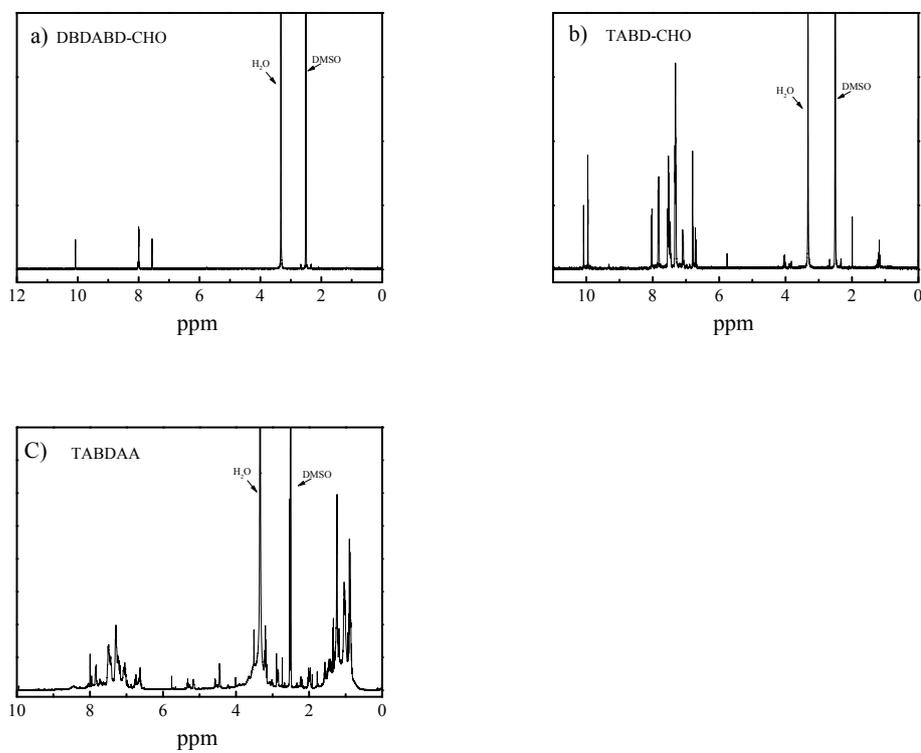


Figure S1. ¹H-NMR spectra of a) DBDABD-CHO; b) TABD-CHO; c) TABDAA.

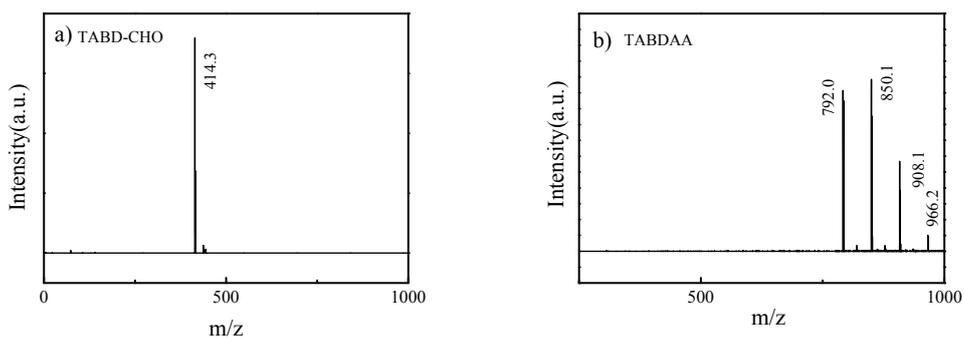


Figure S2. MALDI MS spectra of a) TABD-CHO; b) TABDAA

As shown in Figure S2 a), the molecular mass of resulting TABD-CHO is 414.3, which is perfectly consistent with the theoretical mass value (414.2) of TABD-CHO. Figure S2 b) is the mass spectra of TABDAA, we can see the molecular mass of TABDAA is ranged from

792.0 to 966.2. And the interval of these four peaks is 58 which is corresponding to the constitutional repeating unit of D230, confirming that TABDAA has been synthesized successfully with pure and ideal chemical formulation following our preparation strategy illustrated in Scheme 1.

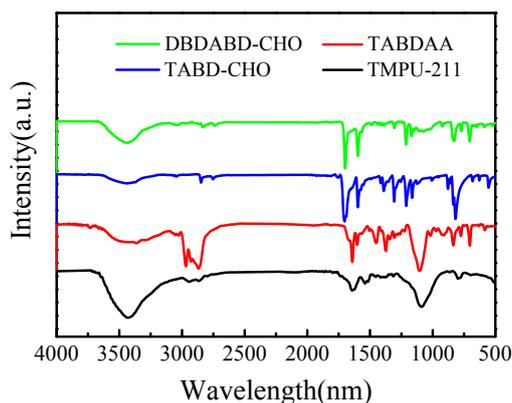


Figure S3. FT-IR spectra of DBDABD-CHO, TABD-CHO, TABDAA and TMPU-211

As depicted in Figure S3, the FTIR spectra of DBDABD-CHO and TABD-CHO showed the characteristic peak of C=O stretching in aldehyde groups at 1703 cm^{-1} . However, the peak in 1703 cm^{-1} was disappeared and the new peak in 1640 cm^{-1} was attributed to C=N stretching in TABDAA and TMPU-211, which confirmed the successful synthesis of monomer TABDAA and the polyurethane TMPU-211.

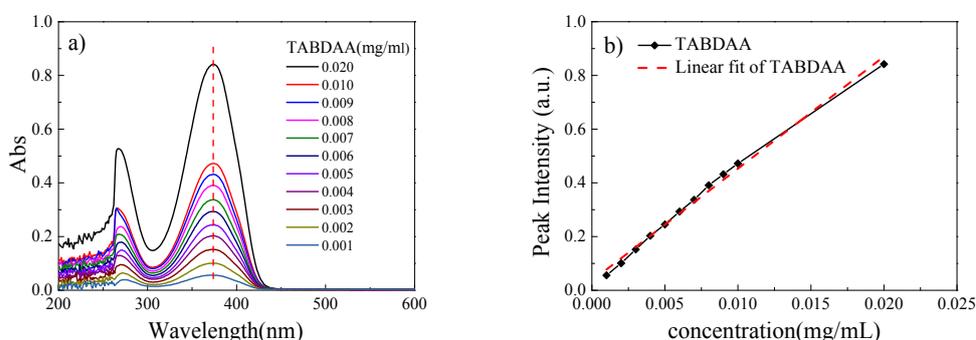


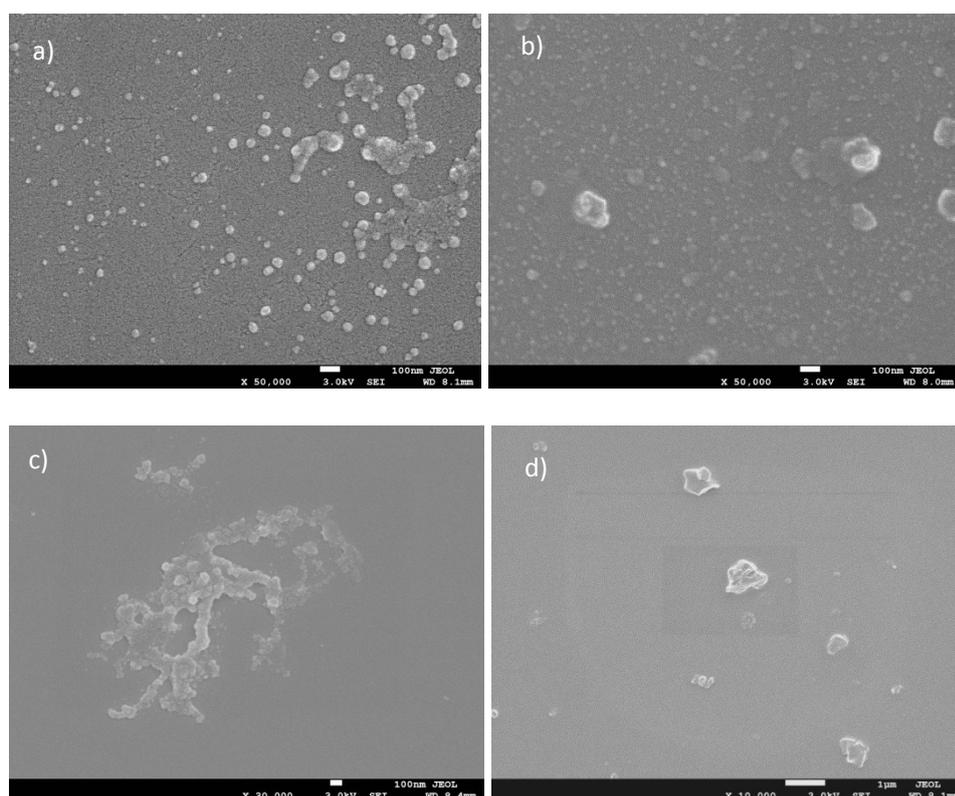
Figure S4. a) UV spectra of TABDAA at different concentration. b) Plot of UV peak intensity and TABDAA solution concentration.

$$A=41.7223c+0.0359 \quad (r^2=0.9929)$$

Equation S1

Standard TABDAA solutions with concentrations ranged from 0.001 mg/mL to 0.02 mg/mL were prepared by volumetric flasks. Then the UV spectra of TABDAA solutions were showed in Figure S4. There are two prominent bands at 265 nm and 375 nm, which can be ascribed to π - π^* transitions of conjugated butadiene and benzene group, respectively. Since the peak at 375 nm is ascribed to the characterized benzene group of TABDAA, it was selected to be a standard peak to measure the mass concentrations of TABDAA in three polurethanes. As described in Figure S4 b), the absorption peak intensity at 375 nm is in proportion to the mass concentration of TABDAA.

Then the Equation S1 can be obtained by fitting the above experimental data, in which c is the TABDAA mass concentration in polyurethane solution and A is the UV absorbance of the corresponding polyurethane solution. By measuring the UV absorbances of three polyurethane solutions which have a same solution concentration of 2.5 mg/mL, TABDAA mass concentrations of three modified polyurethanes can be calculated with Equation S1. And results are showed in Table 3.



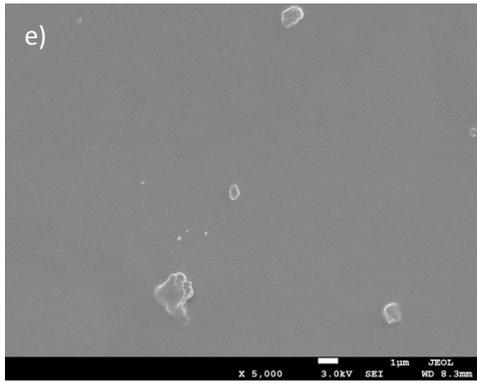
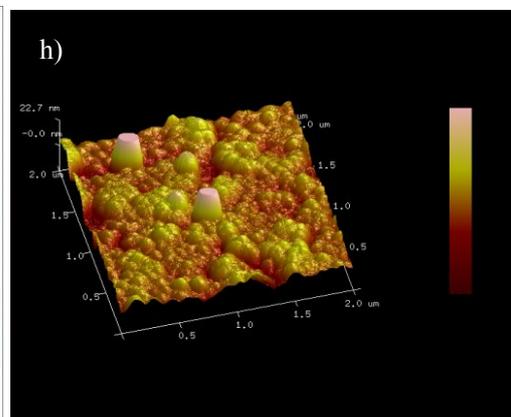
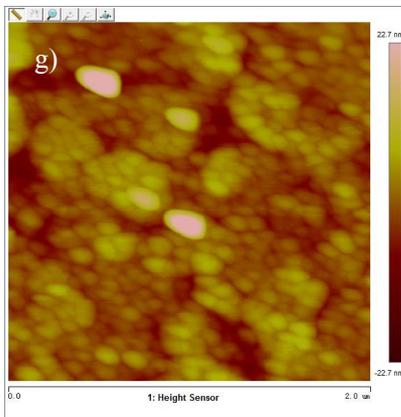
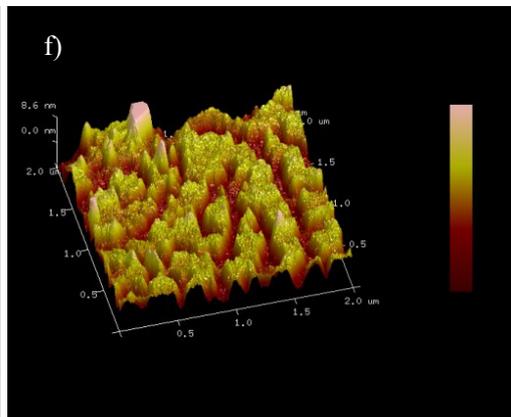
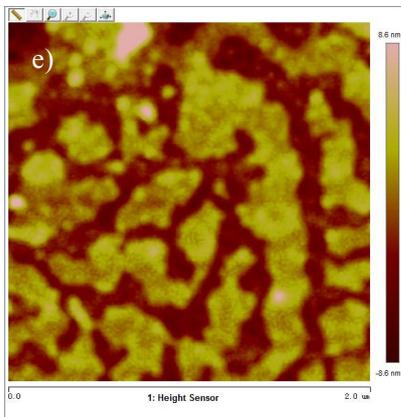
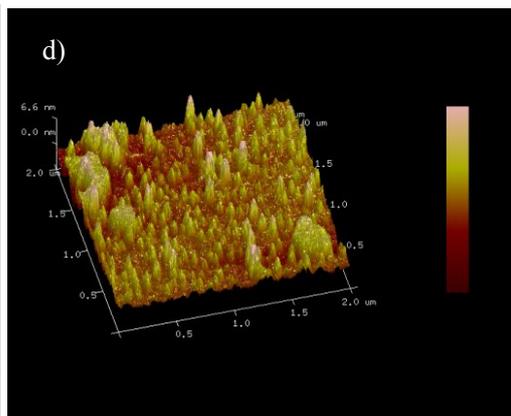
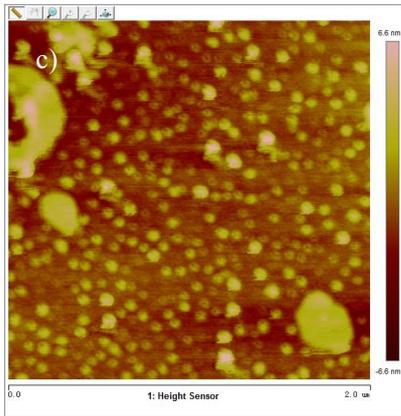
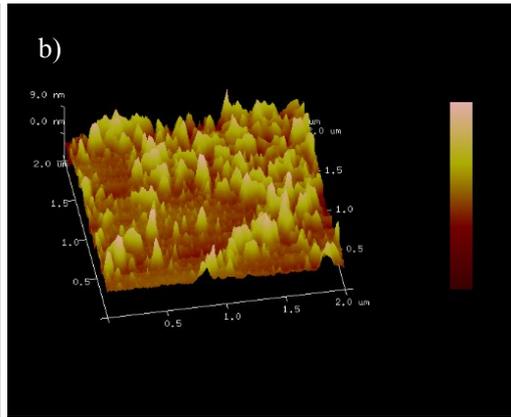
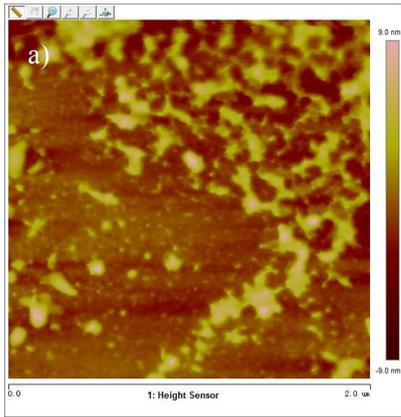


Figure S5. SEM images of TMPU-321: a), b), c), d) and e) are thin films prepared by mixed solutions with different water fractions of 0, 20%, 40%, 60% and 80%, respectively.



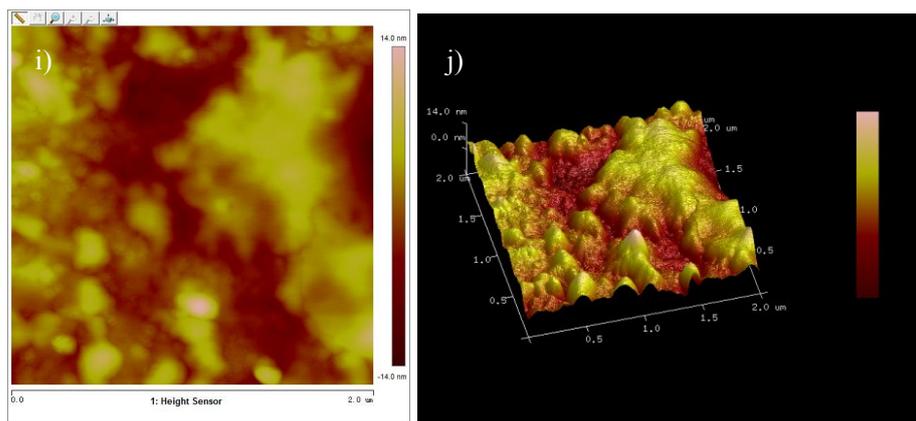
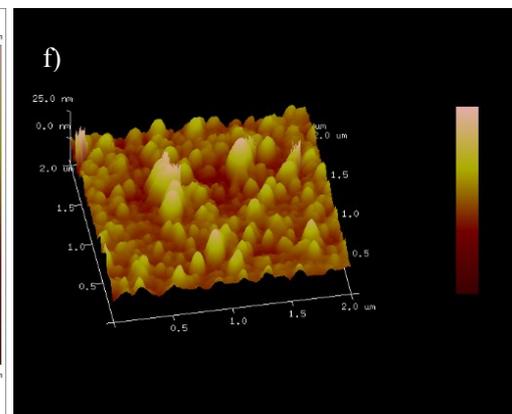
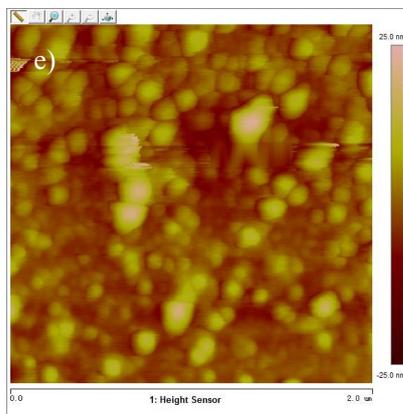
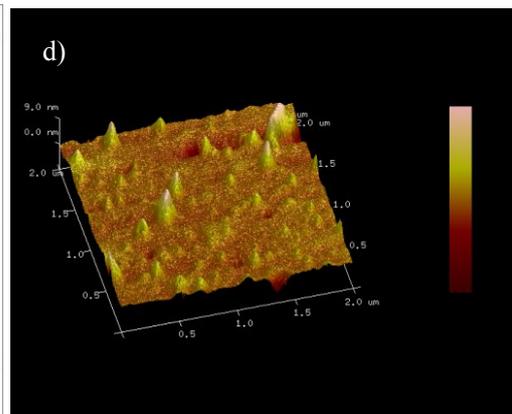
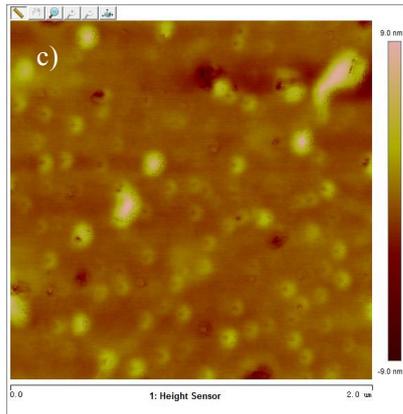
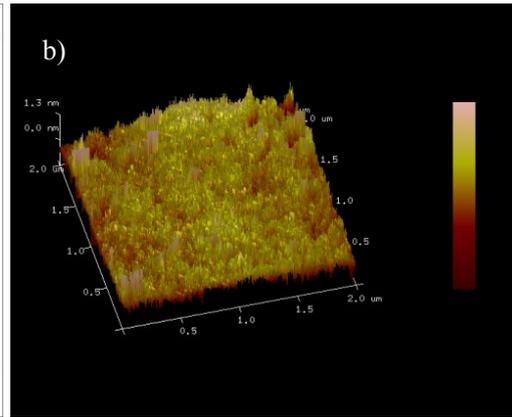
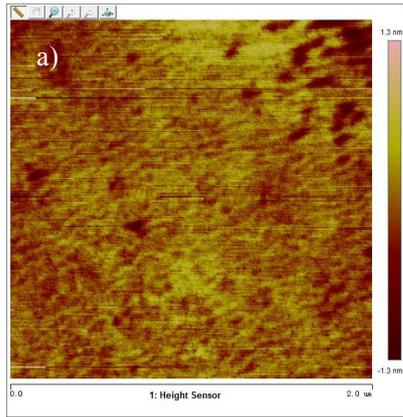


Figure S6. AFM images of TPU-211 thin films prepared by mixed solutions at different water fractions (fw): a), c), e), g) and i) were height contrast images at fw=0%, 20%, 40%, 60%, 80%, respectively; b), d), f), h) and j) were the corresponding 3D Height contrast images of a), c), e), g) and i), respectively.



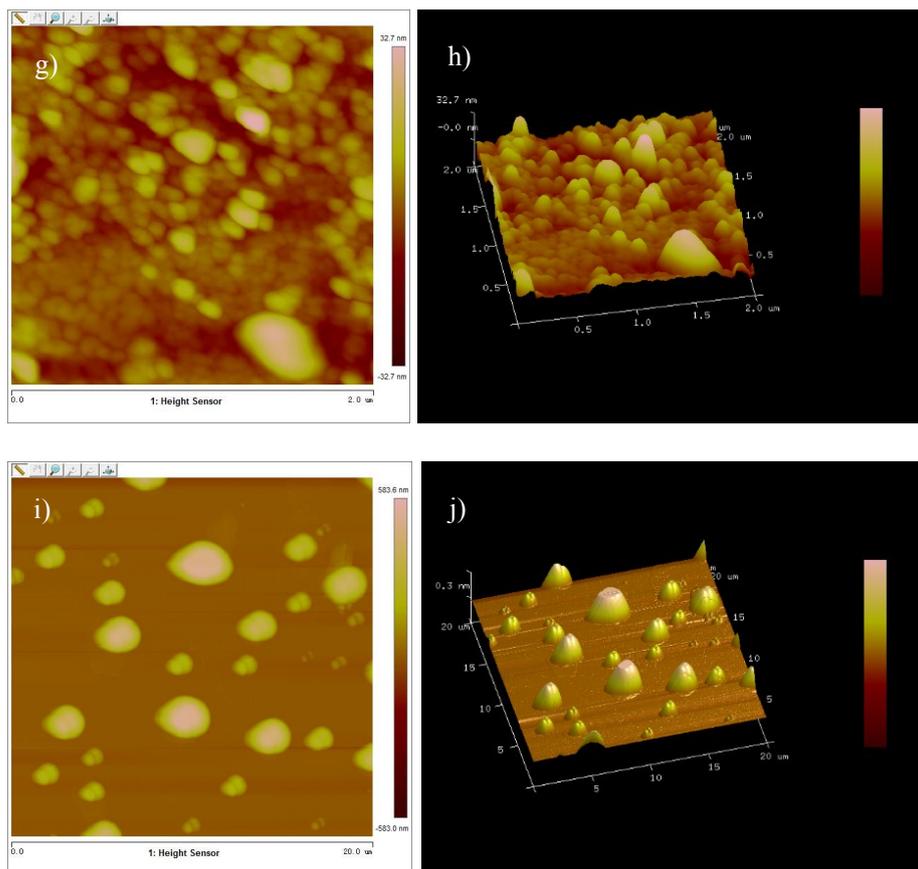


Figure S7. AFM images of TMPU-431 thin films prepared by mixed solutions at different water fractions (fw): a), c), e), g) and i) were height contrast images at fw=0%, 20%, 40%, 60%, 80%, respectively; b), d), f), h) and j) were the corresponding 3D Height contrast images of a), c), e), g) and i), respectively.

Table S1. Diameter of three polyurethane films coated on the glass

| TMPU | 0%(nm) | 20%(nm) | 40%(nm) | 60%(nm) | 80%(nm) |
|-------------|---------------|----------------|----------------|----------------|----------------|
| TMPU-211 | 40 | 60 | 200 | 220 | 600 |
| TMPU-321 | 40 | 130 | 200 | 240 | 1280 |
| TMPU-431 | 40 | 140 | 200 | 400 | 2360 |