

Supplementary Material

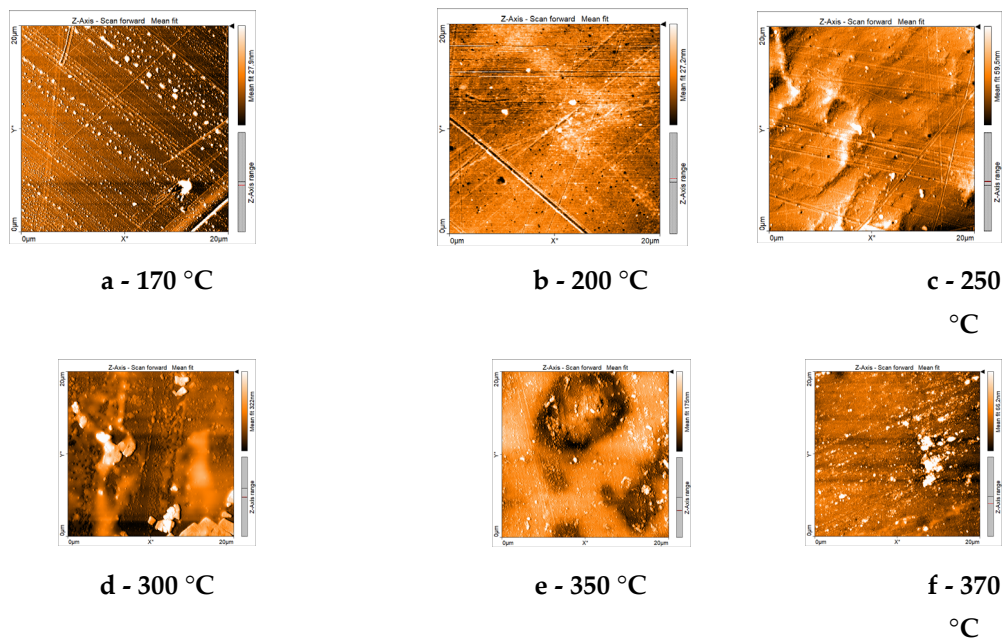


Figure S1. AFM images of free surface of PUI copolymer at different stages of warming (a) -170°C, (b)-200°C, (c)-250°C, (d)-300°C, (e)- 350°C (f)-370°C, in topography mode; the scanning matrix is $20 \times 20 \mu\text{m}$.

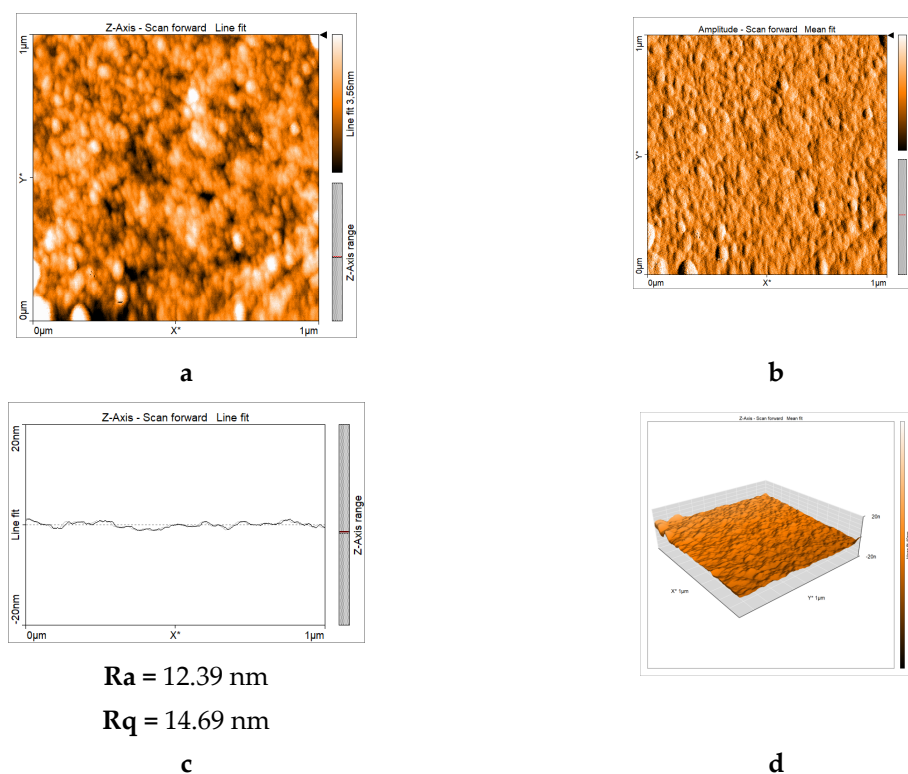
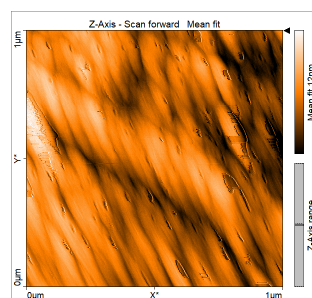
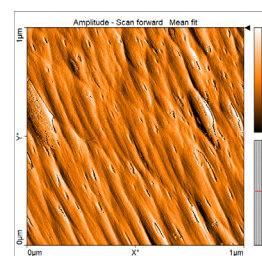


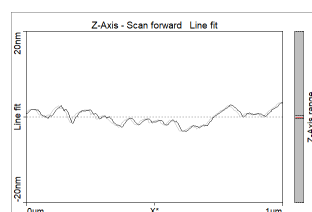
Figure S2. AFM images of free surface of PUI copolymer film heated at °C, in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



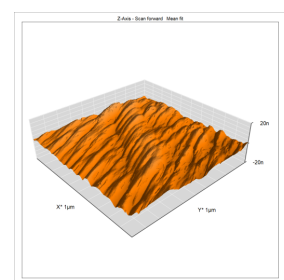
b



$$Ra = 49.23 \text{ nm}$$

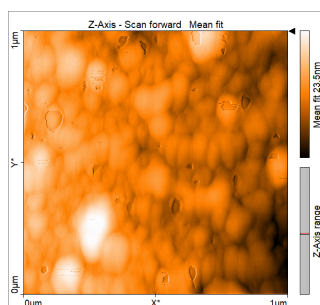
$$Rq = 57.70 \text{ nm}$$

c

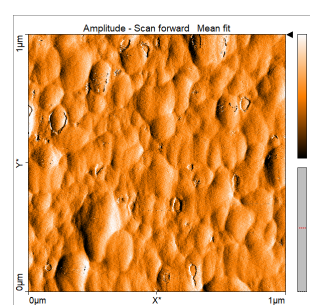


d

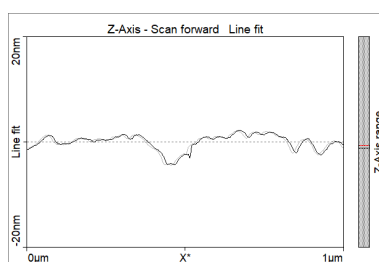
Figure S3. AFM images of free surface of PUI copolymer film heated at 250°C (sample No. 1), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



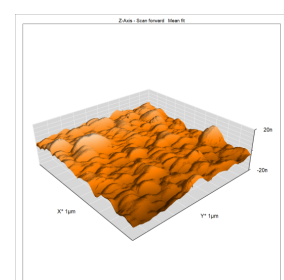
b



$$Ra = 11.60 \text{ nm}$$

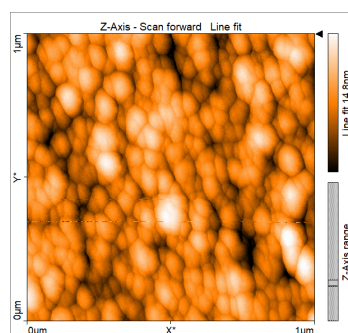
$$Rq = 18.05 \text{ nm}$$

c

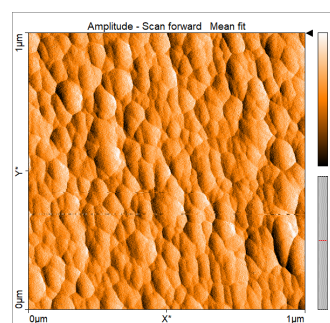


d

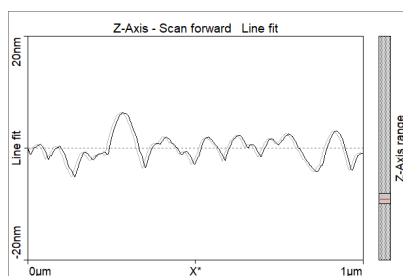
Figure S4. AFM images of free surface of PUI copolymer film heated at °C (sample No. 1), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



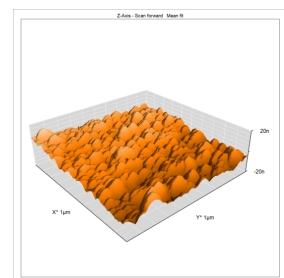
b



Ra = 130.18 nm

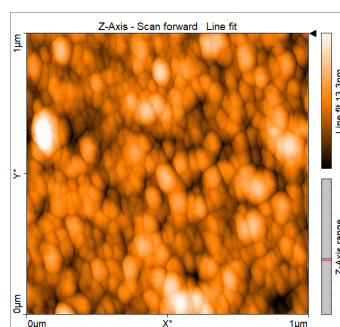
Rq = 150.85 nm

c

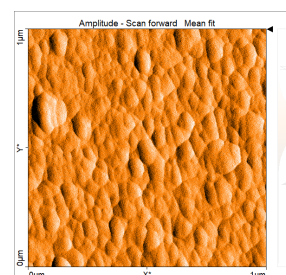


d

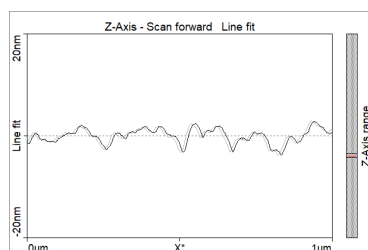
Figure S5. AFM images of free surface of PUI copolymer film heated at 350°C (sample No. 1), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



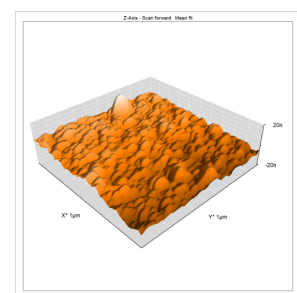
b



Ra = 46.85 nm

Rq = 55.19 nm

c



d

Figure S6. AFM images of free surface of PUI copolymer film heated at 370°C (sample No. 1), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).

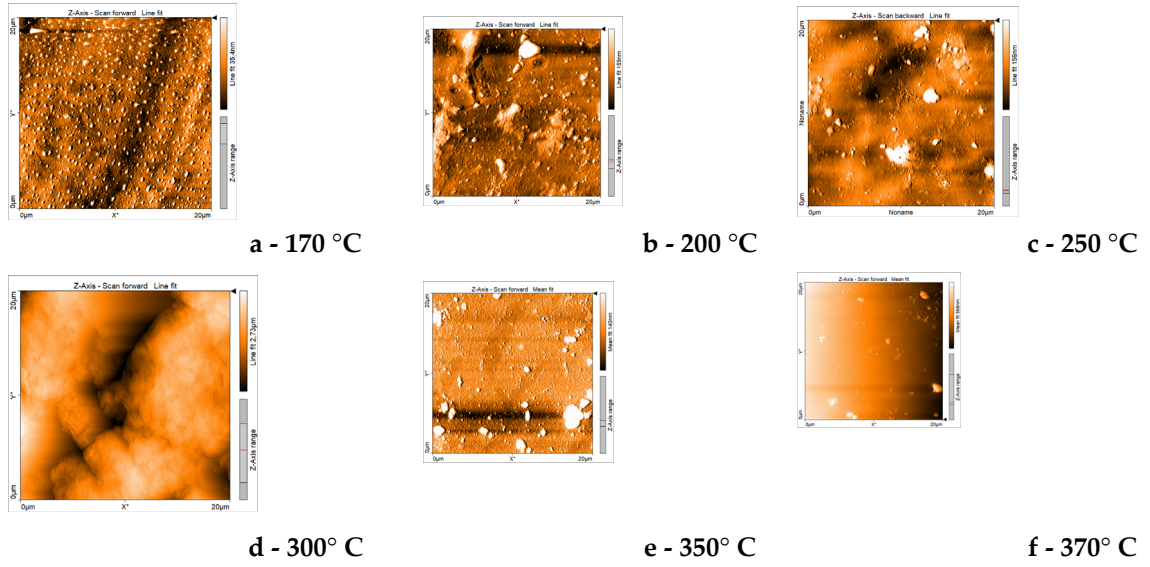


Figure S7. AFM images of free surface of *PUI2* copolymer at different stages of warming (a) -170°C, (b)-200°C, (c)-250°C, (d)-300°C, (e)- 350°C (f)-370°C, in topography mode; the scanning matrix is 20 × 20 μm.

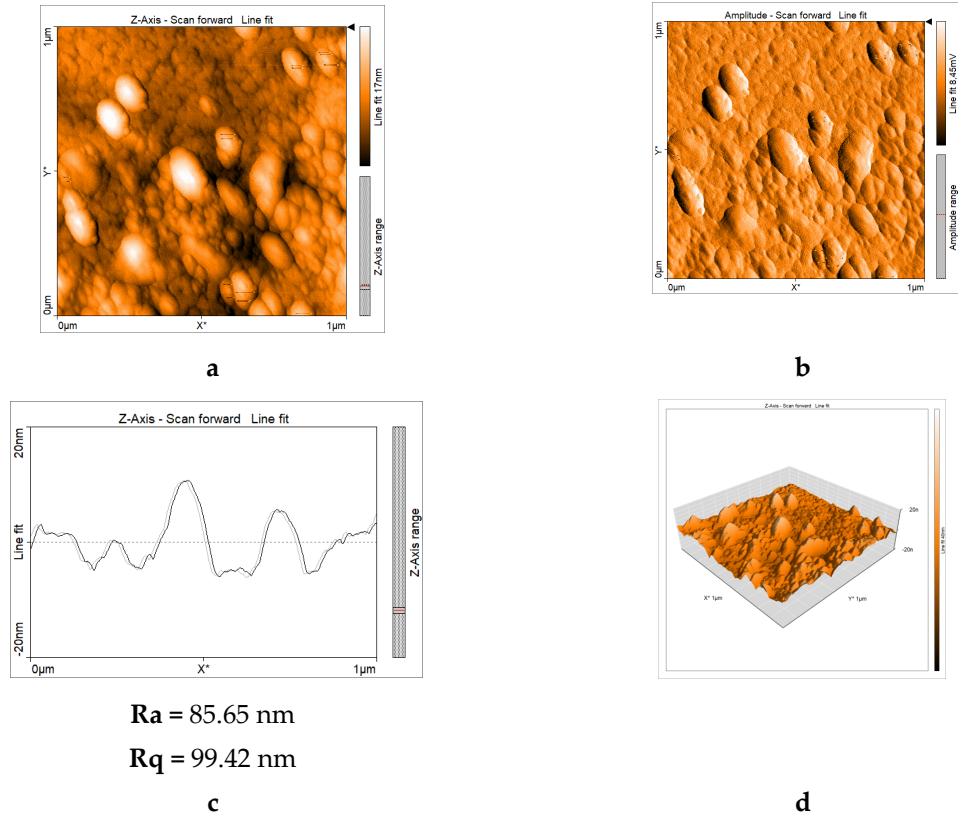
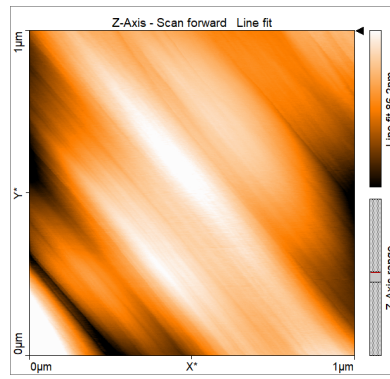
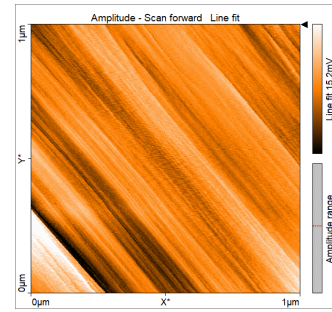


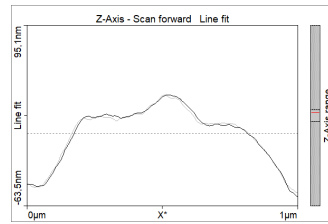
Figure S8. AFM images of free surface of *PUI2* copolymer film heated at 250°C (sample No. 2), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



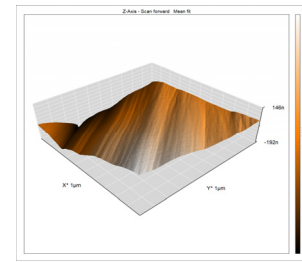
b



Ra = 140.44 nm

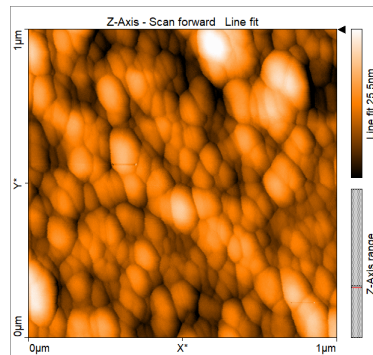
Rq = 167.54 nm

c

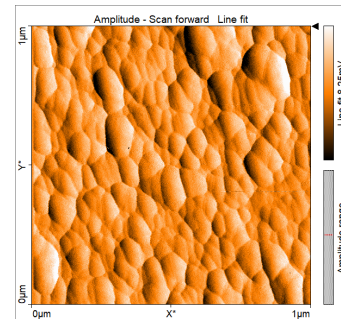


d

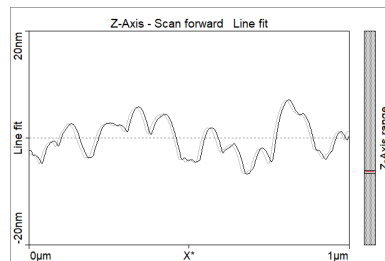
Figure S9. AFM images of free surface of *PUI2* copolymer film heated at 300°C (sample No. 2), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



a



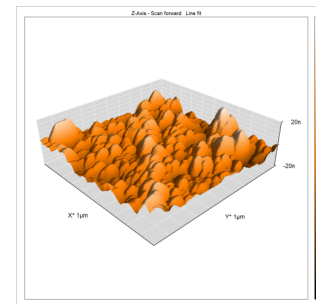
b



Ra = 42.56 nm

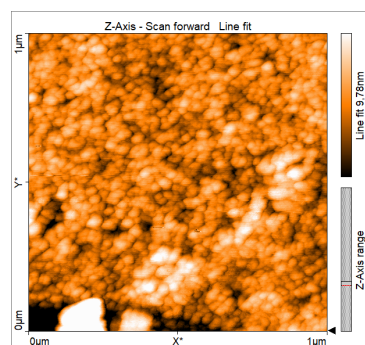
Rq = 48.31 nm

c

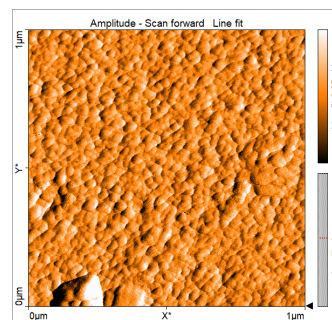


d

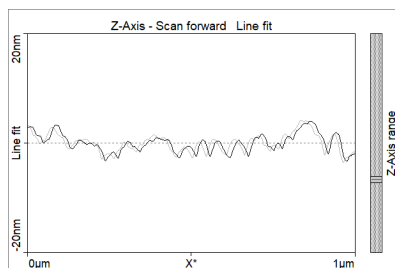
Figure S10. AFM images of free surface of *PUI2* copolymer film heated at 350°C (sample No. 2), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



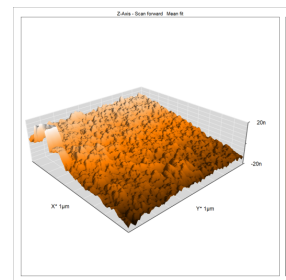
a



b



c

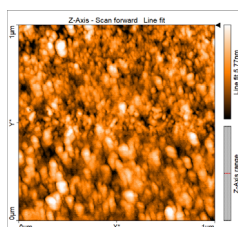


d

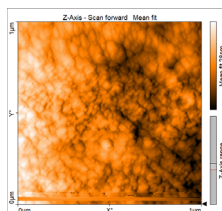
$Ra = 75.96 \text{ nm}$

$Rq = 92.90 \text{ nm}$

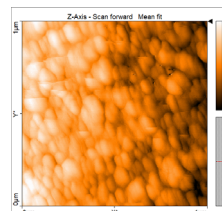
Figure S11. AFM images of free surface of *PUI2* copolymer film heated at 370°C (sample No. 2), in topography mode (a), amplitudes (b), profile of the selected surface area (c), 3D-image (d).



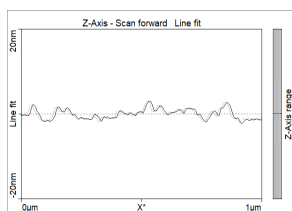
a



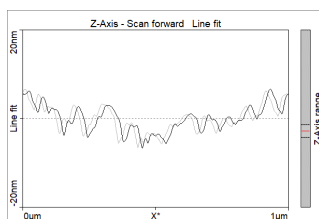
b



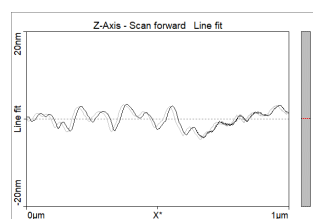
c



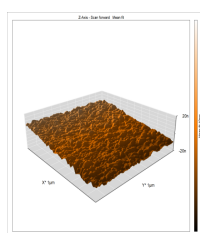
d



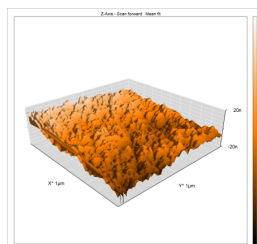
e



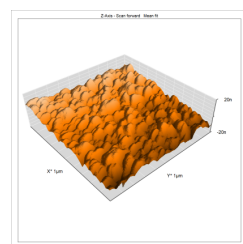
f



$Ra = 9.699 \text{ nm}$
 $Rq = 11.349 \text{ nm}$



$Ra = 20.56 \text{ nm}$
 $Rq = 23.01 \text{ nm}$



$Ra = 4.39 \text{ nm}$
 $Rq = 5.177 \text{ nm}$

g

h

i

Figure S12. AFM images of the free surface of the *PUI* polymer film subjected to hydrolysis by various mixtures after heating: topography (a), profile of the selected surface area (d), 3D-image (g), hydrolysis by composition I (a mixture of hydrochloric and acetic acids in a ratio of 10:90); topography (b), profile of the selected surface area (e), 3D-image (h), hydrolysis by composition II (a mixture of hydrochloric and acetic acids in a ratio of 90:10); topography (c), profile of the selected surface area (f), 3D-image (i), hydrolysis by composition III (a mixture of $\text{CF}_3\text{COOH} + \text{H}_2\text{O}$ in a ratio of 50:50).

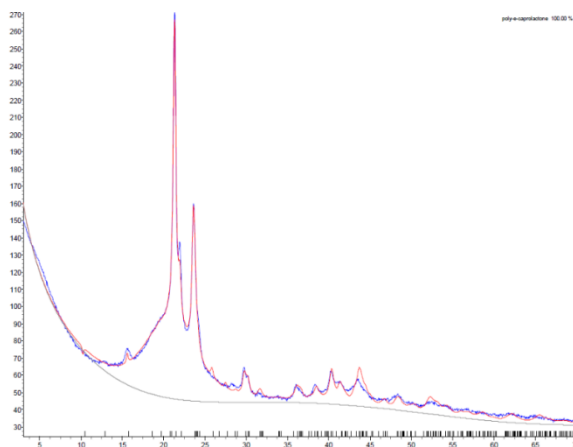


Figure S13. Polycaprolactone diffractogram.

IR studies of thermalized films.

The polyurethaneimide films from which the membranes were formed were examined by infrared spectroscopy. The IR spectrum of poly(urethane-imides) thermalized at various temperatures (170°C, 300°C, 350 °C) is shown in Figure 14. Valence N-H vibrations of the urethane fragment are found in the range of wave numbers: 3310-3450 cm^{-1} , a slight broadening of which is probably due to the participation of N-H in formation of hydrogen bonds. The bands having low intensity and found in the range of 3040-3090 cm^{-1} can be attributed to valence C-H vibrations of aromatic fragments of diamines and dianhydrides. While for aliphatic fragments, bands of valence C-H oscillations were found in the region of 2870-2990 cm^{-1} . The presence of the imide cycle is indicated by the presence of several bands: low intensity bands at 1777 and high intensity bands at 1721 cm^{-1} , which are usually attributed to asymmetric and symmetric C = O oscillations of the imide cycle. The band of symmetrical C = O vibrations of the imide cycle partially overlaps with the bands of C = O vibrations of the caprolactone and urethane fragments, the latter of which manifests itself as a shoulder at 1620 cm^{-1} and this indicates its participation in the formation of hydrogen bonds.

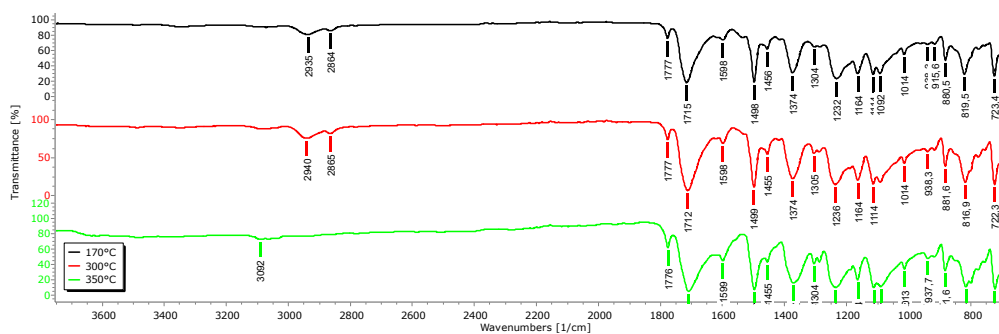


Figure S14. IR spectrum of polyurethane-imide film thermalized at 170°C, 300°C and 350°C.

As a result of thermolysis of poly (urethane imide) at high temperatures (350°C), a partial destruction of the aliphatic block occurs, which manifests itself in the IR spectra of thermalized samples in the form of a change in the intensity of a number of their bands. Namely, there are no bands in the region of 2941 and 2865 cm^{-1} and corresponding to the C-H fluctuations of aliphatic groups. It should also be noted a significant decrease in the intensity of the bands with = Iso vibrations of the urethane fragment at 1620 and 1164 cm^{-1} , respectively.