Supporting information

One-pot Strategy to Access Dynamic Dual Network from Lignin-Initiated Star Polymers by Side Reaction and Transesterification

Quan Yan[a], Bailiang Xue[a*], Tonghe Zhang[a], Wenliang Wang[a], Xinping Li[a], Xiaojun Shen[b], Lulu Ning[a], Xianzhi Meng[c], Wei Zhao[a]

[a] College of Bioresources Chemical and Materials Engineering, Shaanxi University of Science and Technology, Xi'an 710021, Shaanxi, China.

[b] Beijing Key Laboratory of Lignocellulosic Chemistry, Beijing Forestry University, Beijing 100083, China

[c] Department of Chemical & Biomolecular Engineering, University of Tennessee Knoxville, Knoxville, TN 37996, USA

[*]Corresponding authors at: College of Bioresources Chemical and Materials Engineering, Shaanxi University of Science & Technology, Xi'an, Shaanxi 710021, China. Tel.: +86-29-86168575. E-mail address: xuebailiang@sust.edu.cn (B.L. Xue).

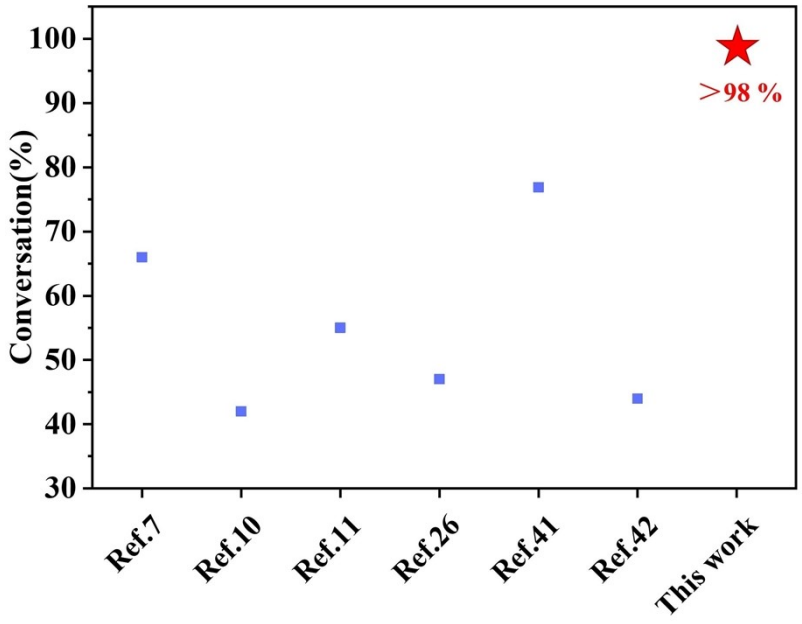


Fig.S1. Comparison of conversion rates with similar work in recent years.

Table S1. Formulations and properties of Lignin, L-CTA and star-shaped lignin-grafted copolymers.

Samples	[I]:[CTA]:[M_1]:[M_2]	Conv.(%)*	M_n(g/mol)	PDI
THF-L	-	-	722	2.0
L-Br	-	-	3544	1.9
L-CTA	-	-	5687	1.4
L-PBA$_{100}$	0.2:1:100:0	70.8	16482	2.0
L-PBA$_{300}$	0.2:1:300:0	68.9	31787	2.0
L-PBA$_{500}$	0.2:1:500:0	73.6	50600	2.4
L-P(BA$_{475}$-*co*-GMA$_{25}$)	0.2:1:475:25	75.8	49181	2.2
L-P(BA$_{450}$-*co*-GMA$_{50}$)	0.2:1:450:50	70.9	44550	1.8
L-P(BA$_{425}$-*co*-GMA$_{75}$)	0.2:1:425:75	77.3	50064	2.4

*This conversion rate is employed to characterise star-shaped lignin-grafted copolymers in the absence of star-star coupling.

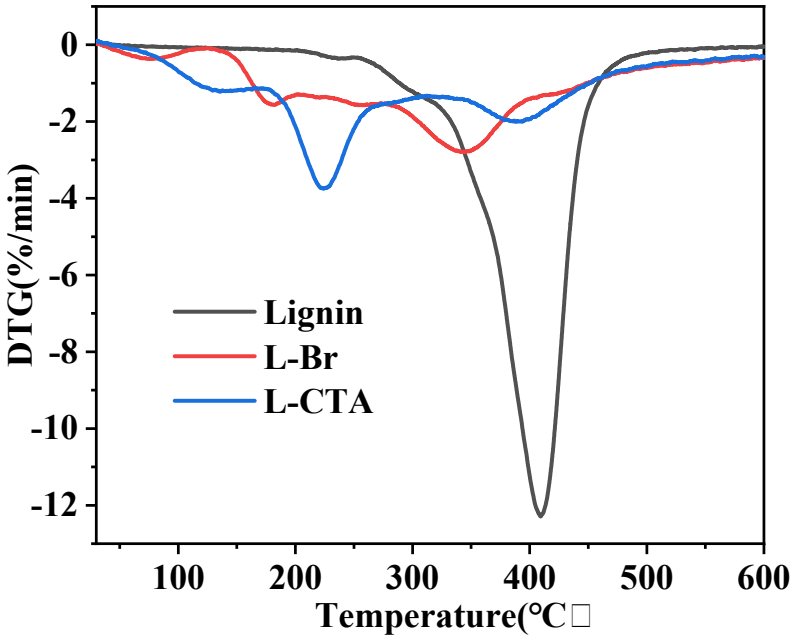


Fig.S2. DTG Images of Lignin, L-Br, and L-CTA.

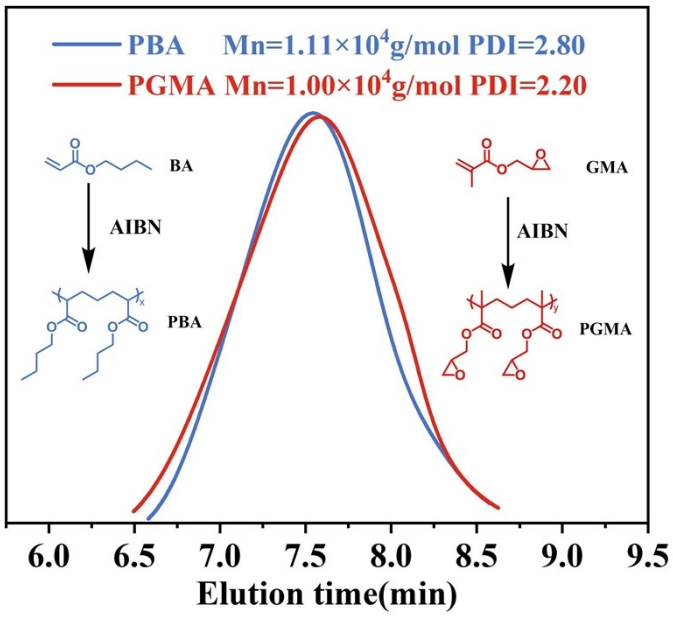


Fig.S3. Verification experiment of the polymerization of monomers and initiators.

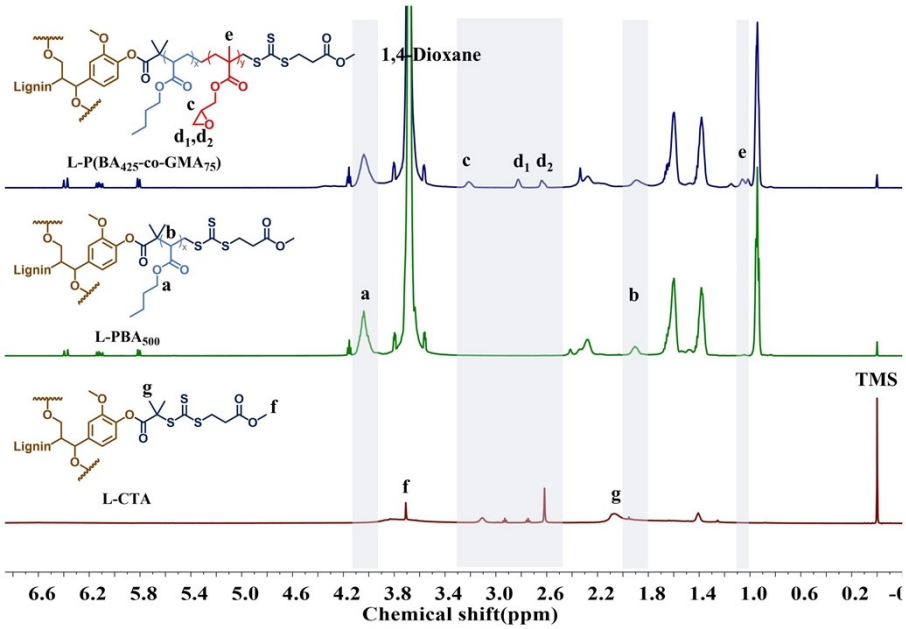
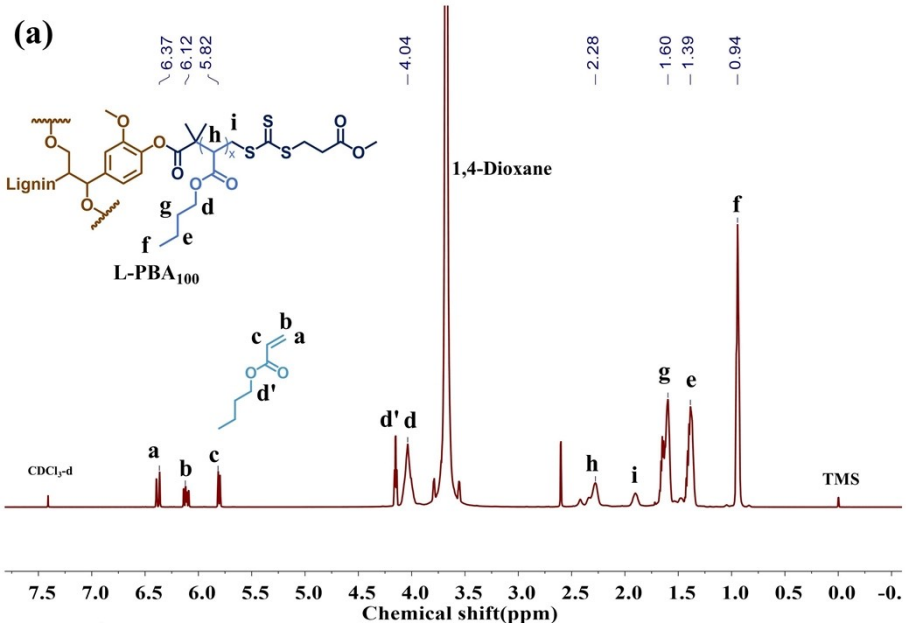


Fig. S4. ^{1}H NMR of L-PBA$_{500}$, L-P(BA$_{425}$-*co*-GMA$_{75}$) and L-CTA.



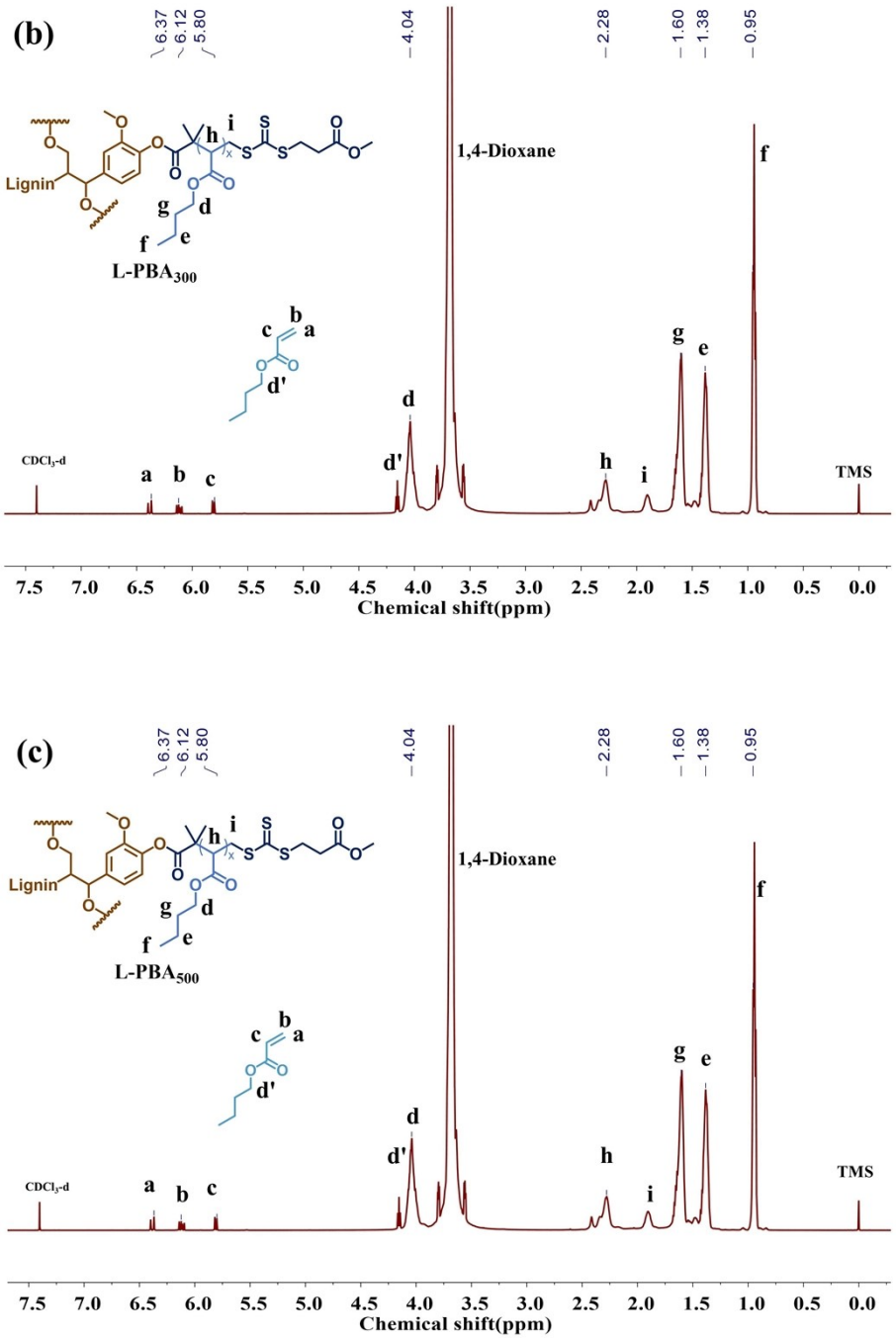
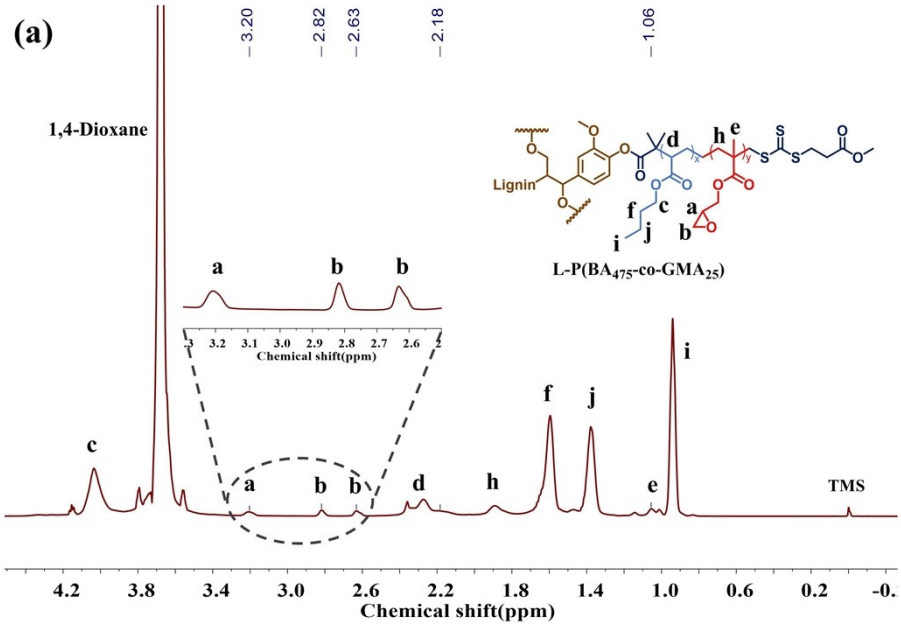
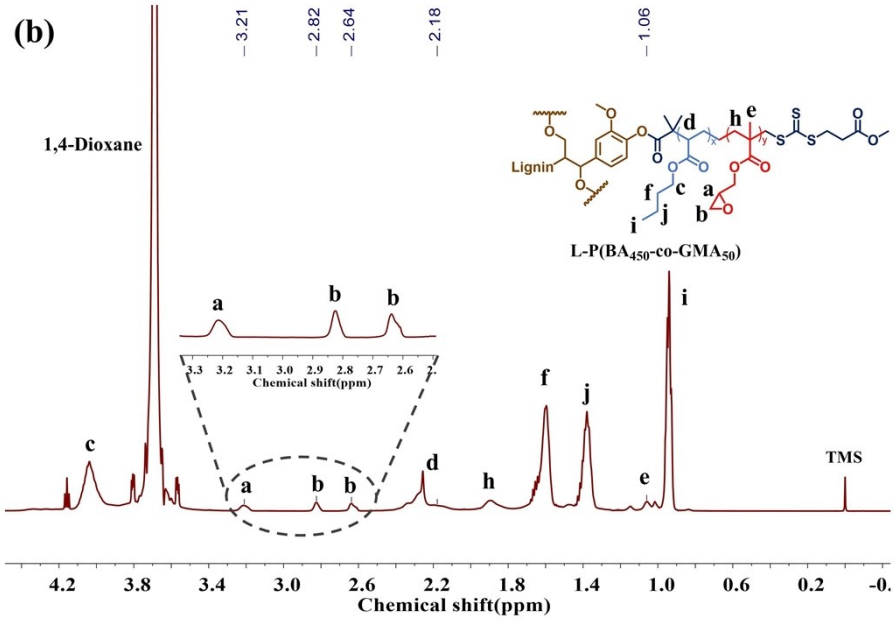


Fig.S5. ^{1}H NMR and characteristic peak display for (a) L-PBA$_{100}$; (b) L-PBA$_{300}$; (c) L-PBA$_{500}$.


(a)
3.20
2.82
2.63
2.18
1.06
1,4-Dioxane
Lignin
L-P(BA475-co-GMA25)
a
b
b
Chemical shift(ppm)
c
a
b
b
d
h
f
j
e
i
TMS
4.2
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0
0.6
0.2
Chemical shift(ppm)


(b)
3.21
2.82
2.64
2.18
1.06
1,4-Dioxane
Lignin
L-P(BA450-co-GMA50)
a
b
b
Chemical shift(ppm)
c
a
b
b
d
h
f
j
e
i
TMS
4.2
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0
0.6
0.2
Chemical shift(ppm)

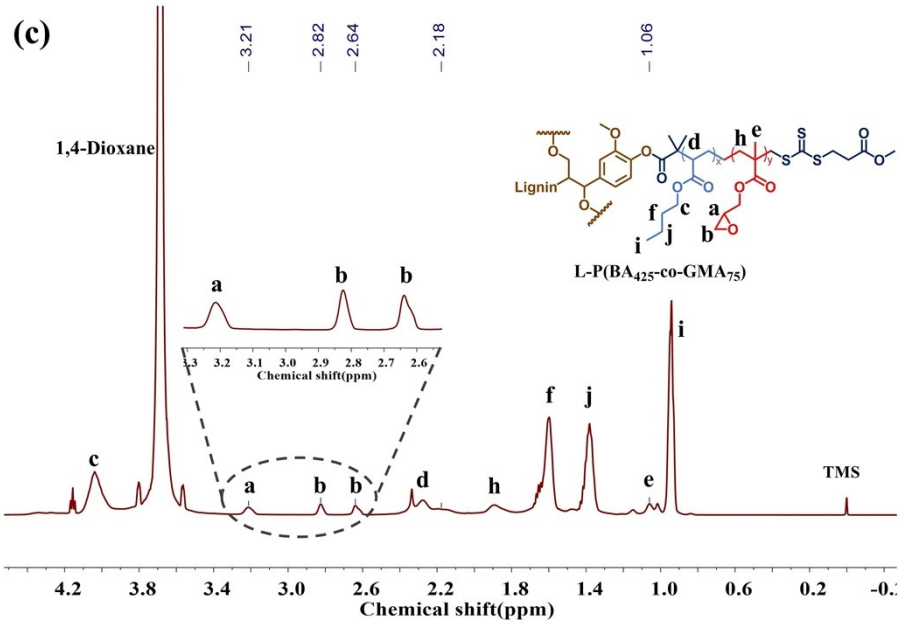


Fig.S6. ^{1}H NMR and characteristic peak display for (a)L-P(BA_{475}-*co*-GMA_{25}) ;(b)L-P(BA_{450}-*co*-GMA_{50}) ;(c)L-P(BA_{425}-*co*-GMA_{75}).

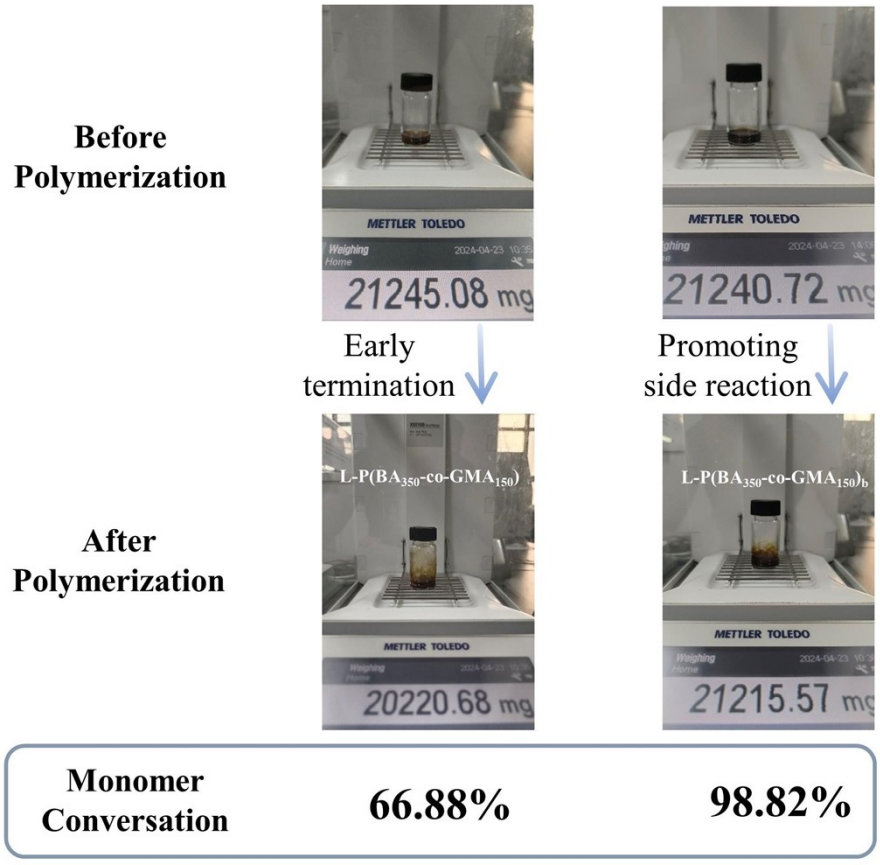


Fig.S7. Monomer conversation of L-P(BA_{350}-*co*-GMA_{150})$_b$ and L-P(BA_{350}-*co*-GMA_{150}).

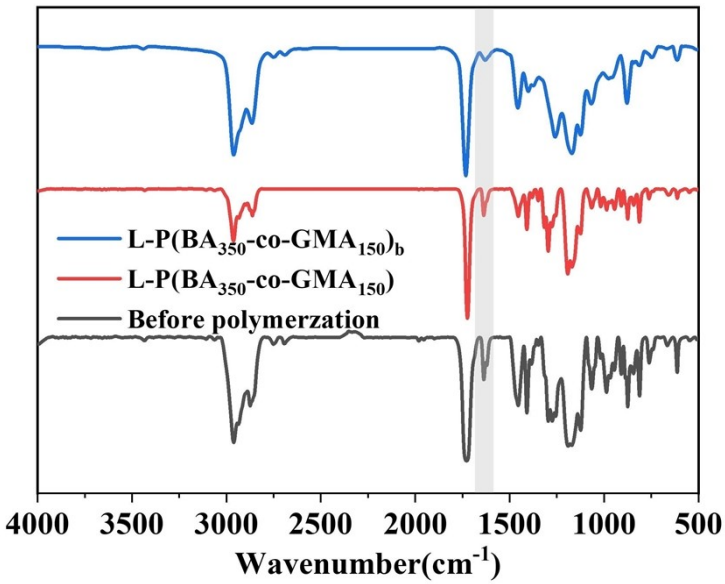


Fig.S8. FT-IR of the solution before polymerization, L-P(BA_{350}-*co*-GMA_{150}) and L-P(BA_{350}-*co*-GMA_{150})$_b$.

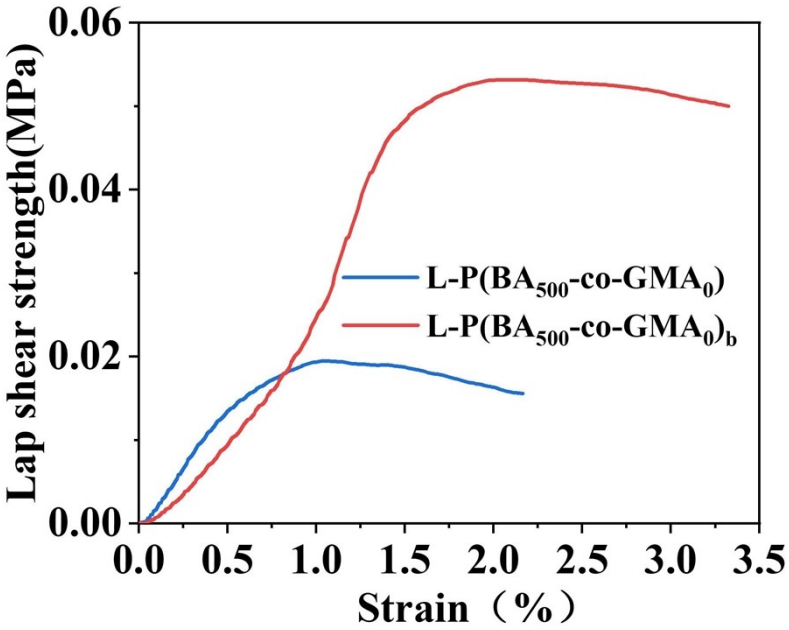


Fig.S9. Bonding performance of L-P(BA_{500}-*co*-GMA_0)$_b$ and L-P(BA_{500}-*co*-GMA_0).

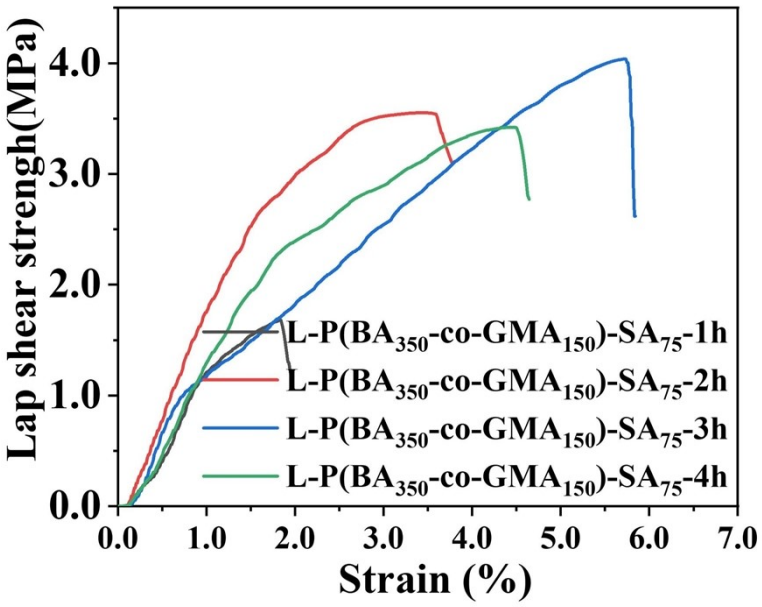


Fig. S10. Lap shear strength of different curing times.

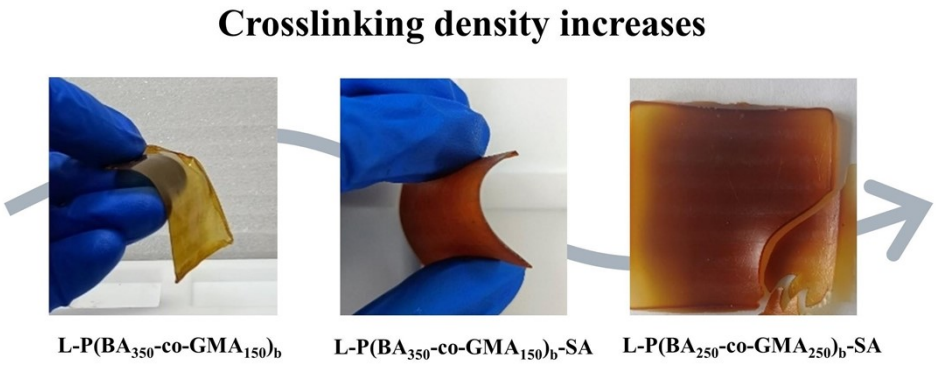


Fig.S11. Images of star-shaped lignin-grafted copolymers samples with varying degrees of cross-linking.