

Supplementary Information (SI) for New Journal of Chemistry.

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**Microphase regulation via benzotriazine-siloxane synergistic  
construction realizes highly stretchable and self-extinguishing  
polyurethane elastomers for flexible sensors**

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## **The synthesis of pristine PU**

PTMEG (6.98 g, 3.5 mmol) was dissolved in dry THF (15 mL), and then added to a 250 mL three-necked flask. Then, the IPDI (1.13 g, 5.1 mmol) and DBTDL (0.2 mL) were gradually added to the flask under a nitrogen atmosphere, and the stirring was continued at 65 °C for 2 h, thus obtaining the IPDI-PTMEG prepolymer. Subsequently, 1, 4-butanediol (0.14 g, 1.5 mmol) was heated and dissolved in THF. Under a nitrogen atmosphere, this solution was continuously added to the prepolymer solution, and stirring was continued at 60 °C for 2.5 h. The resulting THF solution of the target PU elastomer was obtained.

Figures :

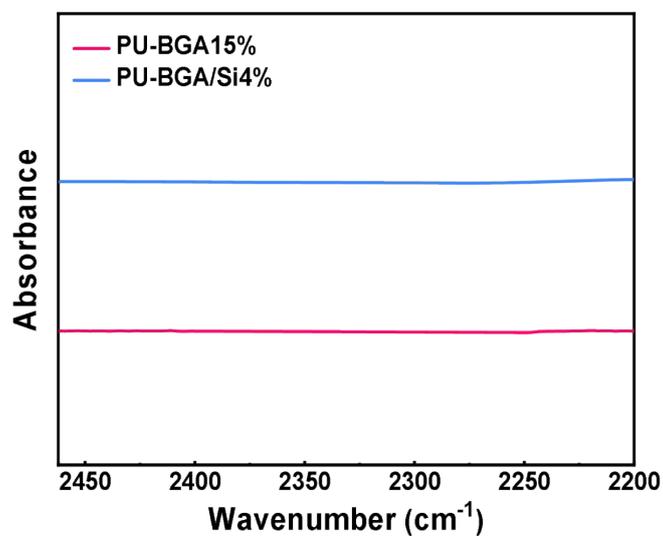


Fig. S1. The magnified FTIR spectra of PU-BGA15% and PU-BGA/Si4%, respectively.

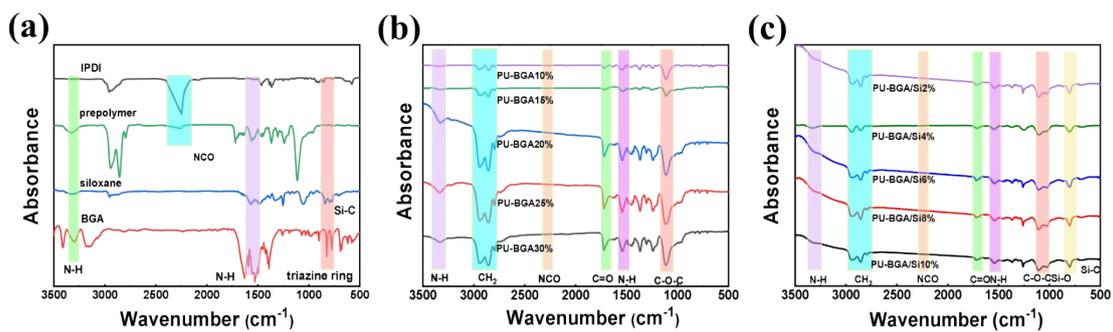
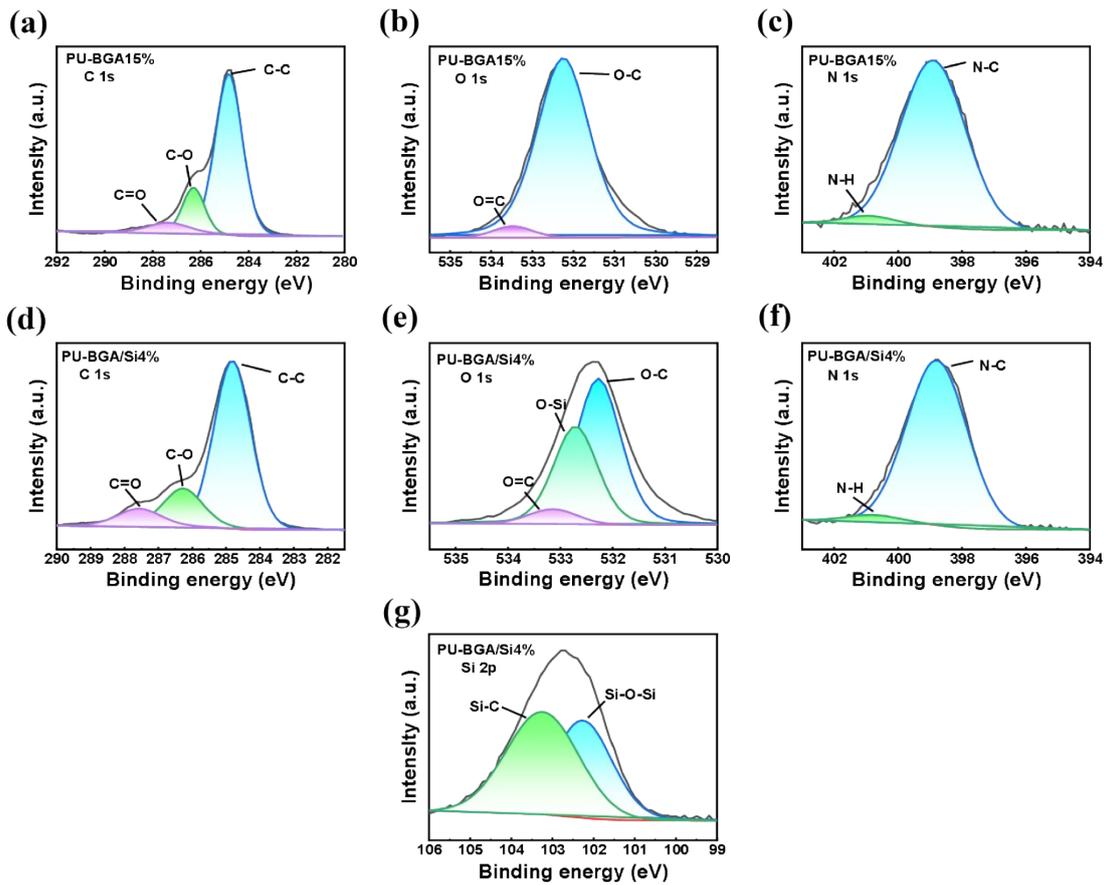
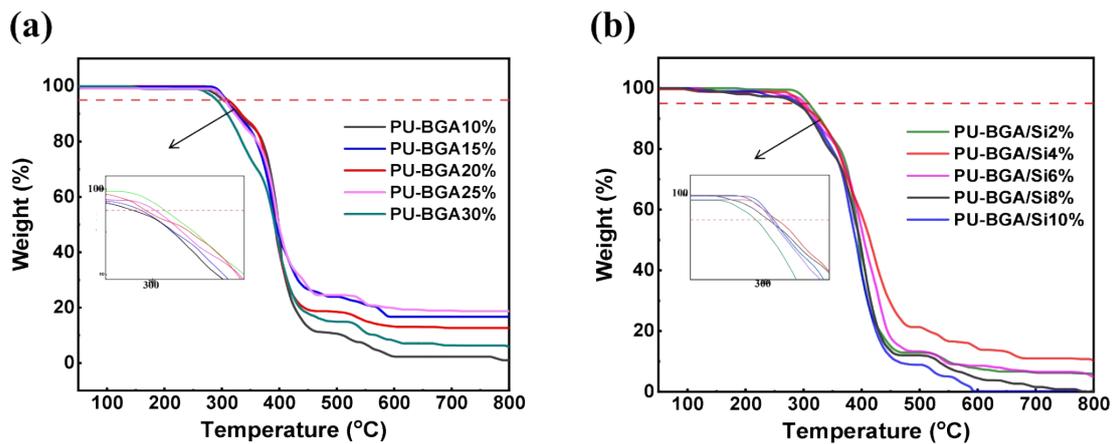


Fig. S2. FTIR spectra of (a) Raw materials and prepolymer, (b) PU-BGA and (c) PU-BGA/Si, respectively.



**Fig. S3.** XPS spectra of (a-c) PU-BGA15% and (d-g) PU-BGA/Si4%, respectively.



**Fig. S4.** TGA curves of (a) PU-BGA and (b) PU-BGA/Si, respectively.

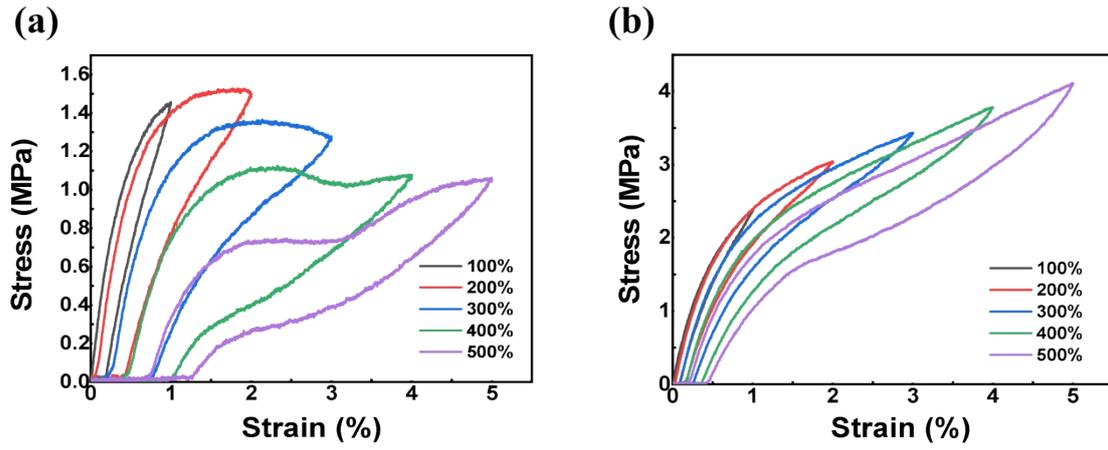


Fig. S5. Load-unload cycle curves at strains from 100% to 500% for (a) PU-BGA15% and (b) PU-BGA/Si4%, respectively.



Fig. S6. Photograph of PU-BGA/Si4% after combustion in a LOI test.

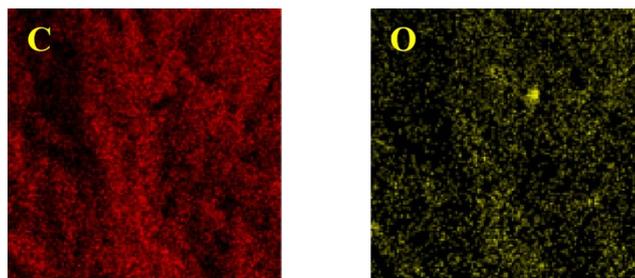


Fig. S7. EDS images of the surfaces after combustion for PU-BGA15%.

Tables :

Table S1. Material ratio for different proportions of PUs.

Samples	IPDI (g)	PTMEG (g)	BGA (g)	Siloxane (g)	$n_{IPDI} : n_{PTMEG} : n_{BGA} : n_{Siloxane}$
PU-BGA10%	1.13	8.02	0.19	0	55.1 : 4 : 1 : 0
PU-BGA15%	1.13	6.98	0.29	0	5.1 : 3.5 : 1.5 : 0
PU-BGA20%	1.13	6.07	0.37	0	5.1 : 3 : 2 : 0
PU-BGA25%	1.13	5.02	0.47	0	5.1 : 2.5 : 2.5 : 0
PU-BGA30%	1.13	4.12	0.57	0	5.1 : 2 : 3 : 0
PU-BGA/Si2%	1.13	6.65	0.29	0.05	5.1 : 3.3 : 1.5 : 0.2
PU-BGA/Si4%	1.13	6.23	0.29	0.10	5.1 : 3.1 : 1.5 : 0.4
PU-BGA/Si6%	1.13	5.83	0.29	0.15	5.1 : 2.9 : 1.5 : 0.6
PU-BGA/Si8%	1.13	5.46	0.29	0.20	5.1 : 2.7 : 1.5 : 0.8
PU-BGA/Si10%	1.13	5.08	0.29	0.25	5.1 : 2.5 : 1.5 : 1

**Table S2.** Mechanical properties of PU samples.

<b>Samples</b>	<b>Strain (%)</b>	<b>Stress (MPa)</b>	<b>Toughness (MJ·m<sup>-3</sup>)</b>
<b>PU-BGA10%</b>	2187	2.86	33.15
<b>PU-BGA15%</b>	1941	9.20	56.87
<b>PU-BGA20%</b>	1493	11.49	54.35
<b>PU-BGA25%</b>	1313	15.50	74.77
<b>PU-BGA30%</b>	1129	18.06	70.01
<b>PU-BGA/Si2%</b>	1697	13.25	75.06
<b>PU-BGA/Si4%</b>	1608	15.08	75.08
<b>PU-BGA/Si6%</b>	1279	15.44	54.35
<b>PU-BGA/Si8%</b>	1107	14.76	74.77
<b>PU-BGA/Si10%</b>	1023	13.53	70.01

**Table S3.** Comparison of the stress and strain for this work and other reported PUs.

Number	References	Stress (MPa)	Strain (%)
S1	<i>Polym. Degrad. Stab.</i> 2025, <b>242</b> , 111636.	12.1	1098
S2	<i>Polym. Degrad. Stab.</i> 2025, <b>236</b> , 111302.	24.4	640
S3	<i>Polym. Degrad. Stab.</i> 2024, <b>230</b> , 111047.	42.7	617
S4	<i>Nano Res.</i> 2024, <b>17</b> , 2186-2194.	9.1	560
S5	<i>Prog. Org. Coat.</i> 2024, <b>194</b> , 108613.	11.6	1451
S6	<i>ACS Appl. Mater. Interfaces</i> 2024, <b>16</b> , 43979-43990.	20.9	812
S7	<i>Polym. Degrad. Stab.</i> 2025, <b>234</b> , 111240.	39.3	286
S8	<i>Adv. Sci.</i> 2025, <b>12</b> , 2412258.	11.5	660
S9	<i>Polym. Degrad. Stab.</i> 2025, <b>242</b> , 111713.	22.6	977
<b>This work</b>		15.1	1608

**Table S4.** UL-94 parallel test of PU-BGA/Si4%.

Number	Ignition time (s)	First flame applications (s)	Second flame applications (s)	Dripping
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<b>1</b>	5	0.2	0.3	Yes
<b>2</b>	5	0.1	0.2	Yes
<b>3</b>	5	0.2	0.1	Yes

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