

*Supporting information for*

**Understanding the thermal degradation mechanism of high-temperature-resistant phthalonitrile foam at macroscopic and molecular levels**

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**Table. S1 Main information of PN foam in Raman spectra**

<b>Sample</b>	<b>F200</b>	<b>F400</b>	<b>F600</b>	<b>F800</b>	<b>F1000</b>
I <sub>D</sub> /I <sub>G</sub>	0.8441	0.8439	0.8061	0.9669	0.9996
D band (cm <sup>-1</sup> )	1352.4	1352.4	1348.5	1333.1	1336.9
G band (cm <sup>-1</sup> )	1564.5	1572.3	1583.8	1585.7	1591.5
2D band (cm <sup>-1</sup> )	2843.1	2779.4	2825.7	2862.3	2852.7

**Table. S2 FWHM values of PN foam on d<sub>002</sub>**

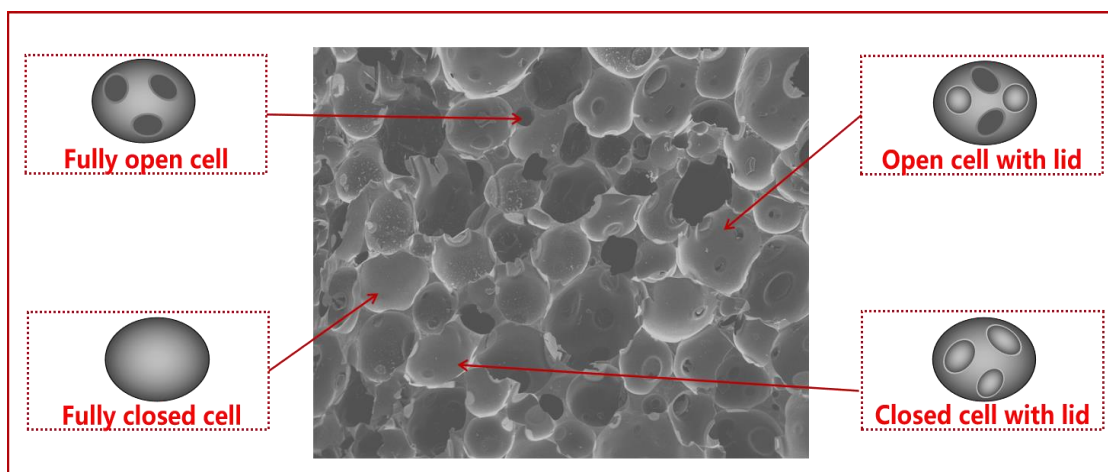
<b>Sample</b>	<b>F200</b>	<b>F400</b>	<b>F600</b>	<b>F800</b>	<b>F1000</b>
FWHM	6.77	11.38	14.35	16.07	17.26

**Table S3 bond energy of covalent bond in PN foam [1]**

<b>Bond type</b>	<b>C-N</b>	<b>C-O</b>	<b>C-C</b>	<b>N-H</b>	<b>C-H</b>	<b>O-H</b>	<b>C=C</b>	<b>C=N</b>	<b>C=O</b>	<b>C≡N</b>
<b>Bond energy (kJ/mol)</b>	305	326	332	391	414	464	611	615	728	891

**Reference**

[1] Sanderson R. Chemical bonds and bonds energy. Elsevier, 2012.



**Figure. S1. Bubble types in PN foams**

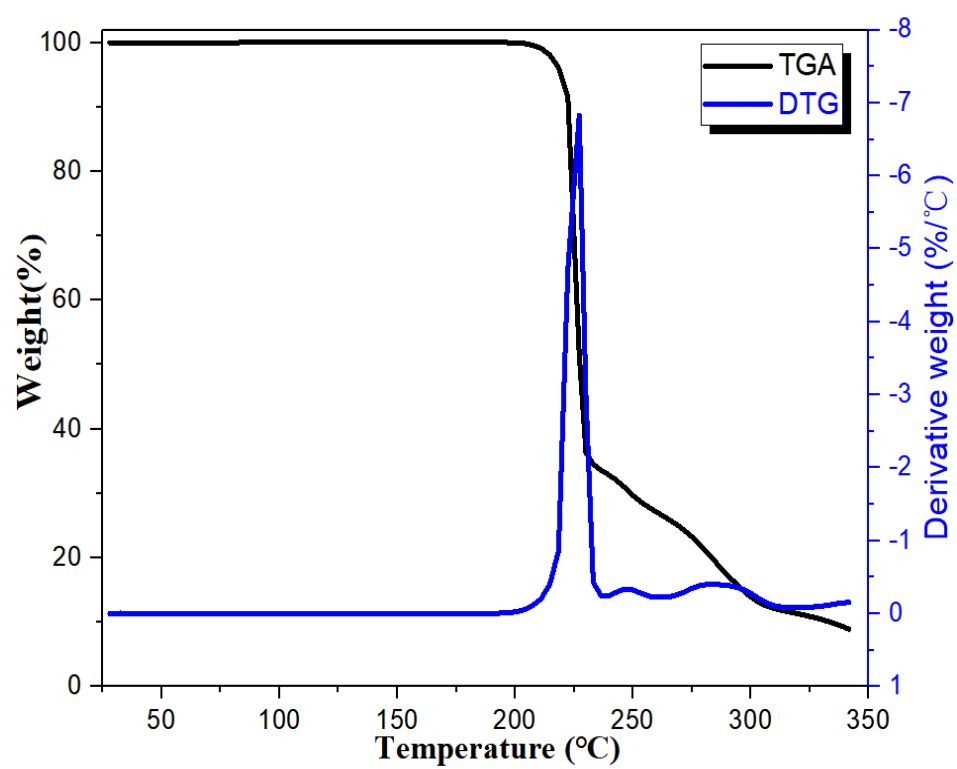


Figure. S2 TGA/DTG curves of azodicarbonamide

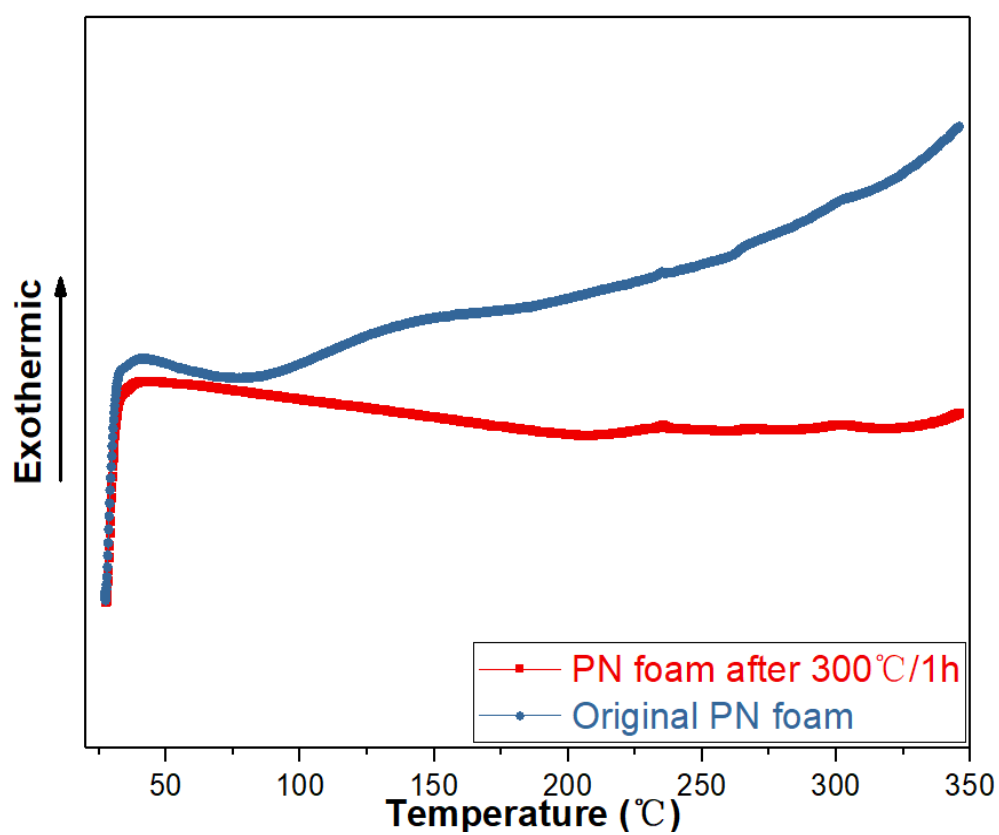


Figure. S3. DSC curve of (a) original PN foam and (b) PN foam after after thermal treatment at 300 °C/1h

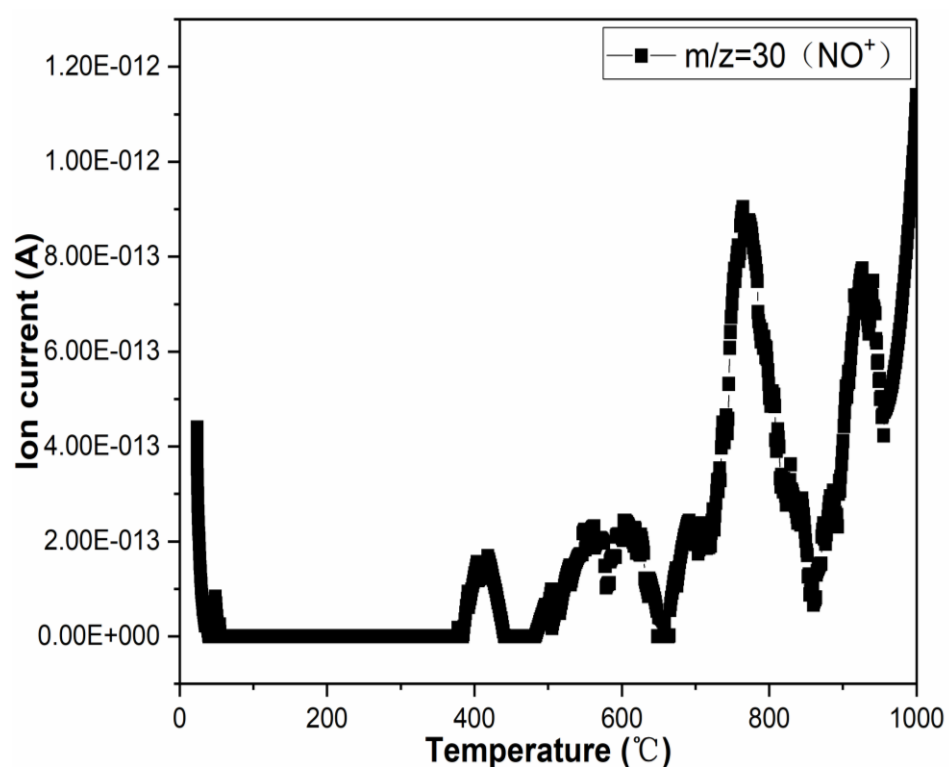


Figure. S4 The ionic signal of NO



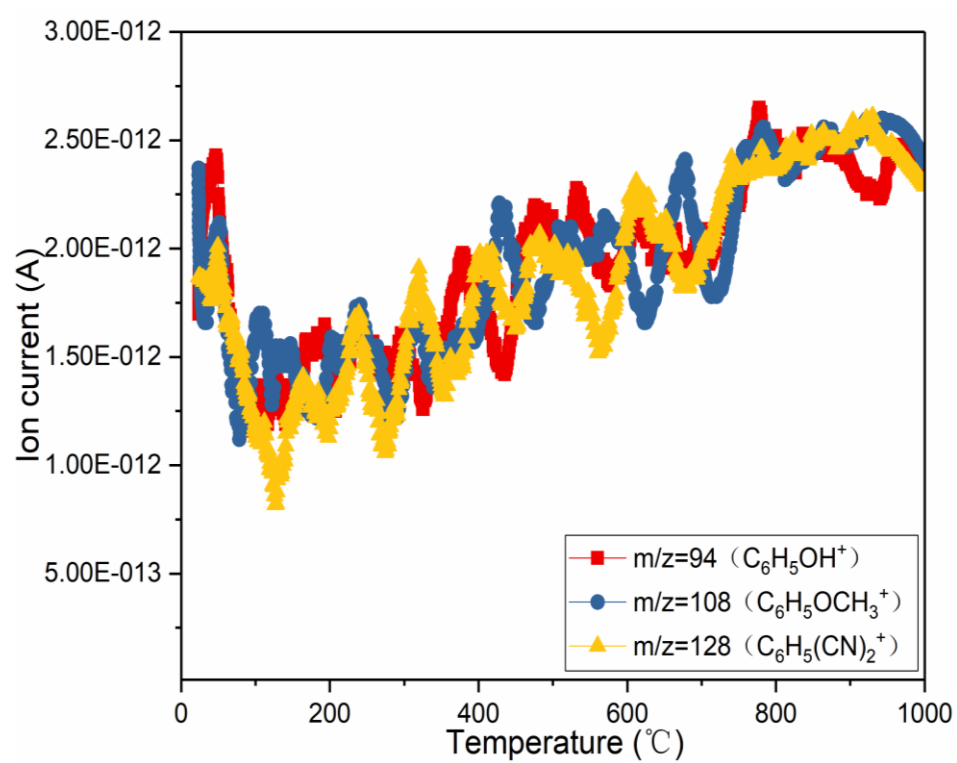


Figure. S5 The ionic signals of aromatics