

Supplementary Information

High-performance, recyclable, and multifunctional nitrile butadiene rubber based on hydrogen and urea bonds

Lin Wang¹, Manman Jia¹, Hui Jiao¹, Shukang Ti¹ and Dongmei Yue^{*1,2}

¹State Key Laboratory of Organic-Inorganic Composites, Beijing University of
Chemical Technology, Beijing, 100029, China

Key Laboratory of Beijing City on
Preparation and Processing of Novel
Polymer Materials, Beijing University of
Chemical Technology, Beijing, China

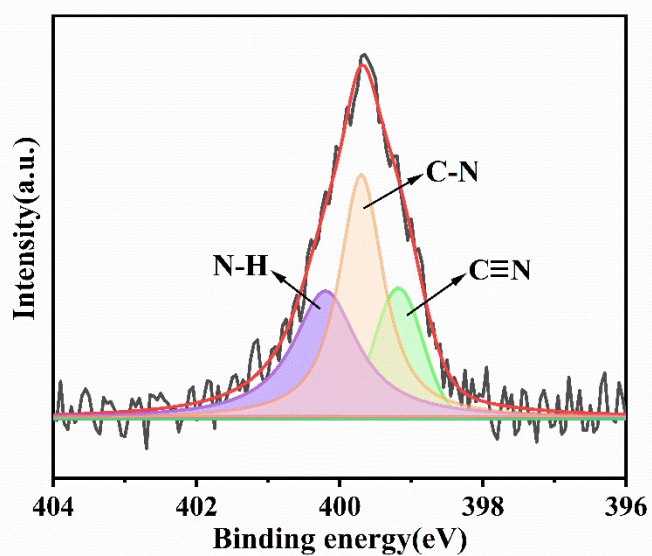
²Key Laboratory of Beijing City on Preparation and Processing of Novel Polymer
Materials, Beijing University of Chemical Technology, Beijing, 100029, China

*Corresponding author:

E-mail: yuedm@mail.buct.edu.cn

Table S1 Compositions of the samples.

Sample	Molar ratio IPDI: ATBN: PPD	HS content (%)
I-A _{0.7} -P _{0.3}	1:0.7:0.3	8.7
I-A _{0.6} -P _{0.4}	1:0.6:0.4	10.3
I-A _{0.5} -P _{0.5}	1:0.5:0.5	12.6
I-A _{0.4} -P _{0.6}	1:0.4:0.6	15.8
I-A _{0.3} -P _{0.7}	1:0.3:0.7	20.4



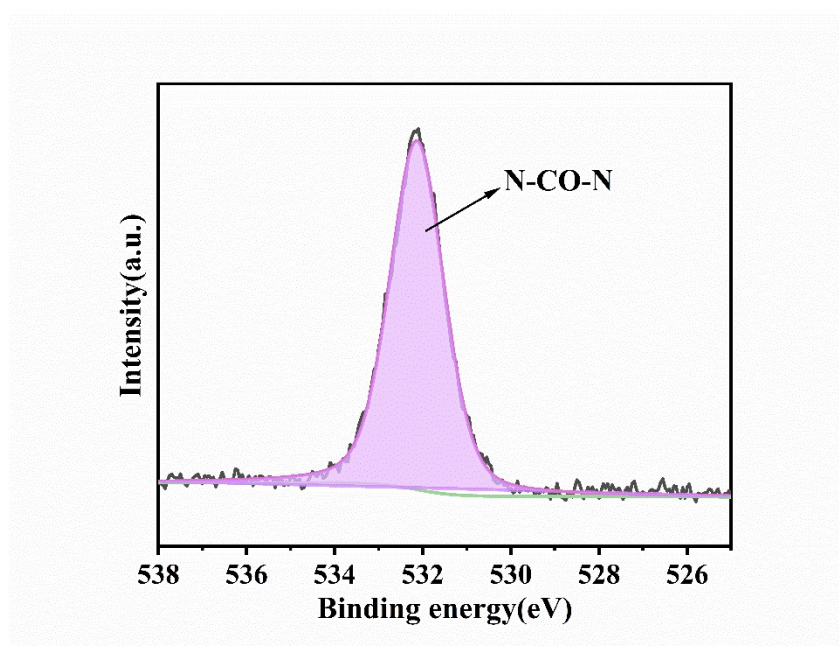


Fig. S1 XPS spectra of the N 1s and O 1s orbital and their fitting curves of the I-A_{0.5}-P_{0.5}.

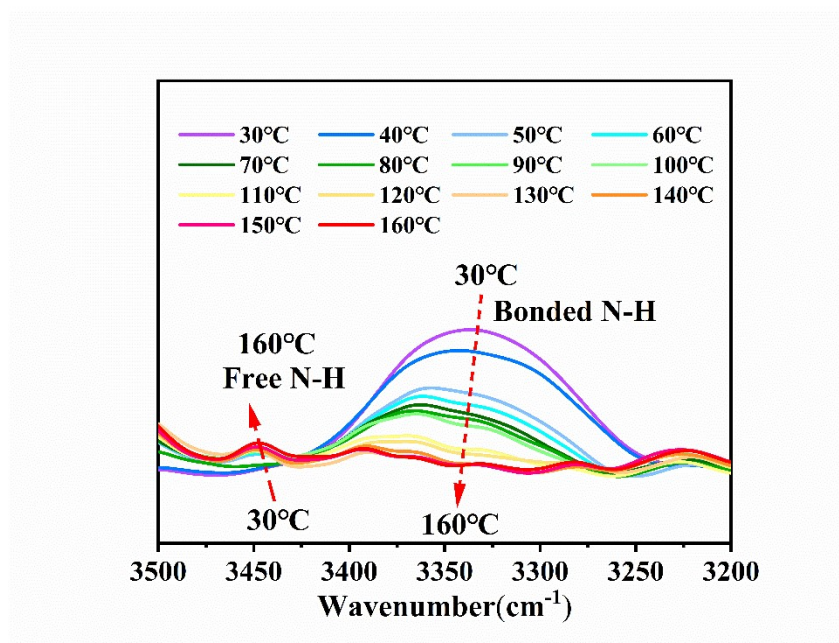


Fig. S2 *In situ* variable-temperature FT-IR spectra of the I-A_{0.5}-P_{0.5} during the healing process of N-H stretching vibration band.

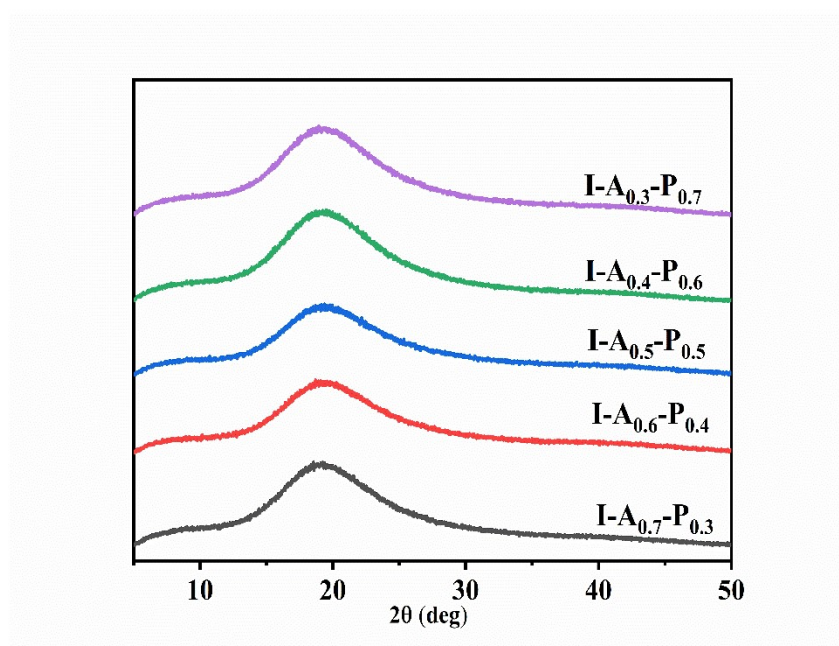


Fig. S3 WAXD curves of IPDI-ATBN-PPD.

Table S2 The mechanical performance values of the samples.

Sample	Tensile strength (MPa)	Elongation at break (%)
I-A0.7-P0.3	9.6±0.2	907±20
I-A0.6-P0.4	15.2±0.5	949±30
I-A0.5-P0.5	19.9±0.6	984±50
I-A0.4-P0.6	13.4±0.4	764±25
I-A0.3-P0.7	10.7±0.6	528±18

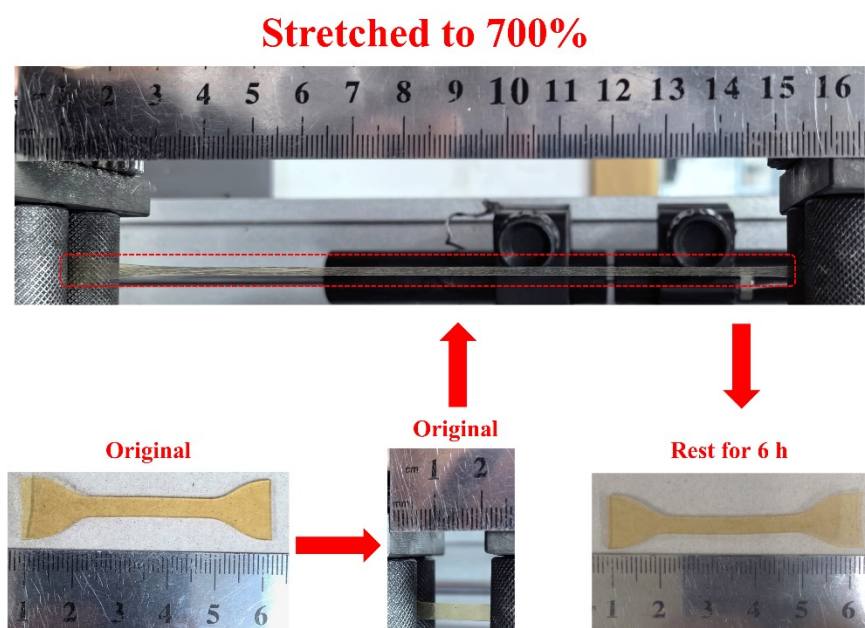


Fig. S4 Excellent elastic recovery ability of the I-A_{0.5}-P_{0.5}.

Table S3 The mechanical performance values of I-A_{0.5}-P_{0.5} before and after repeated processing.

Sample	Tensile strength (MPa)	Elongation at break (%)
I-A _{0.5} -P _{0.5} (Original)	19.9±0.6	984±50
I-A _{0.5} -P _{0.5} -1 st -R	18.7±0.4	901±30
I-A _{0.5} -P _{0.5} -2 nd -R	18.1±0.5	862±40
I-A _{0.5} -P _{0.5} -3 rd -R	17.3±0.7	879±45
I-A _{0.5} -P _{0.5} -4 th -R	17.2±0.3	955±35
I-A _{0.5} -P _{0.5} -5 th -R	16.1±0.5	975±46

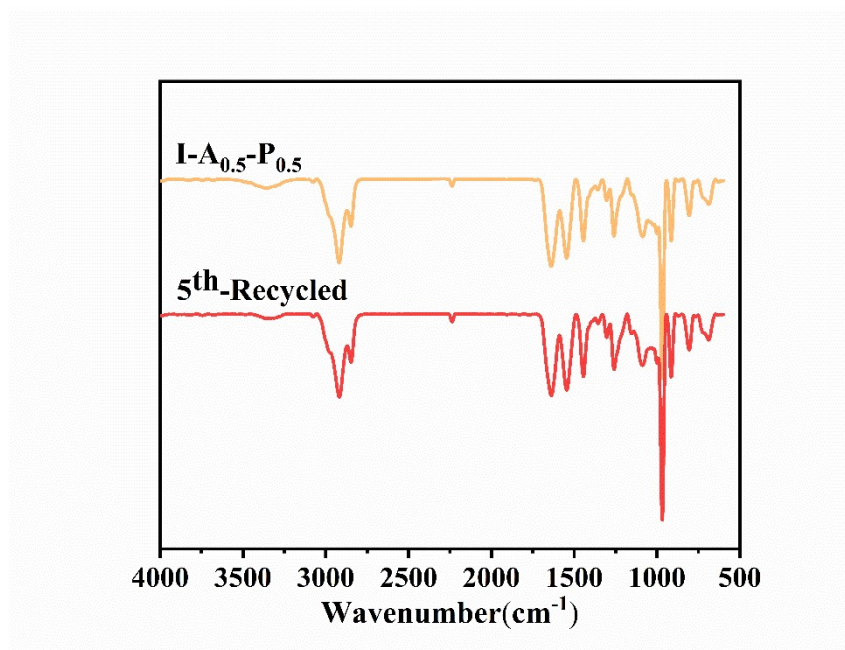


Fig. S5 FT-IR spectra of I-A_{0.5}-P_{0.5} original and after recycling five times.

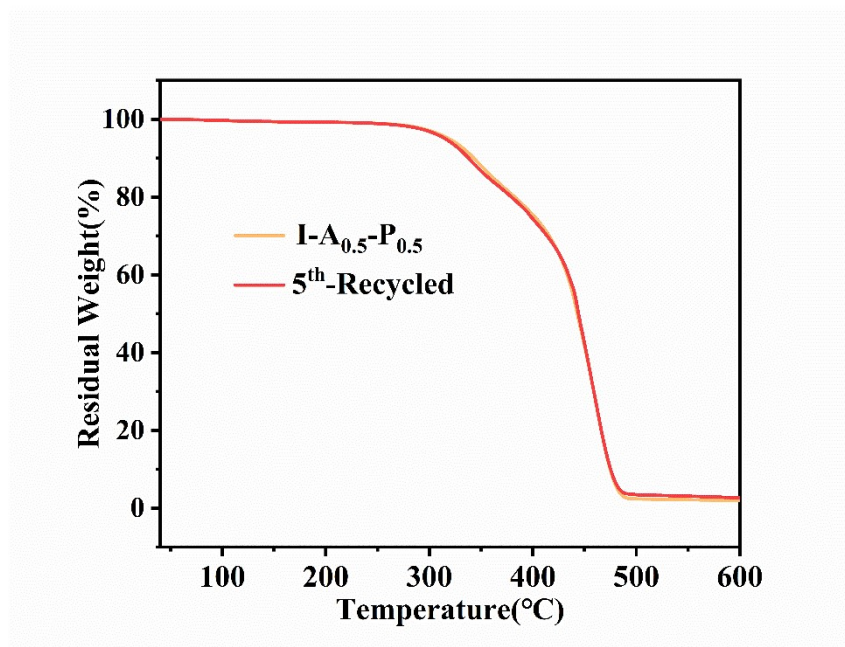


Fig. S6 TGA spectra of I-A_{0.5}-P_{0.5} original and after recycling five times.

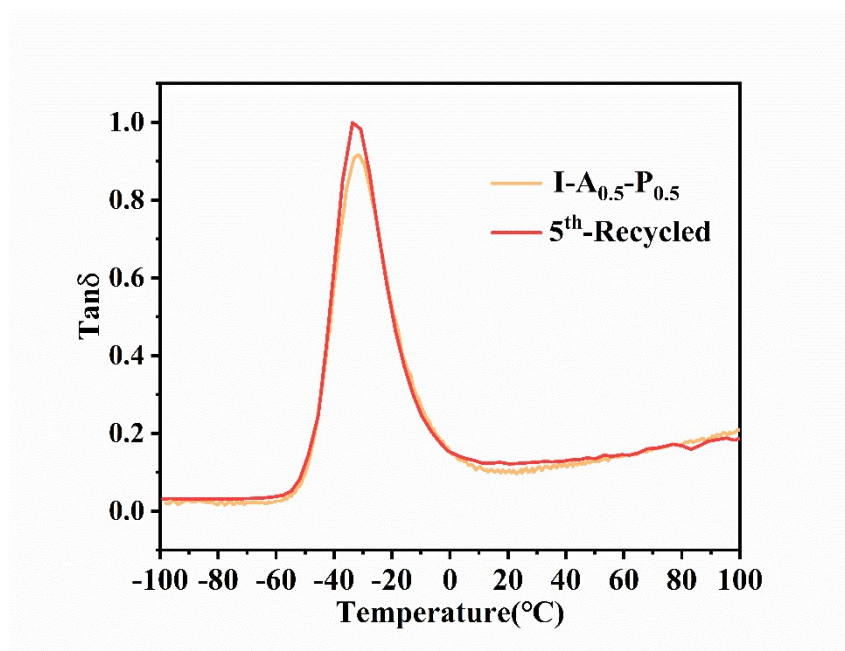


Fig. S7 DMA spectra of I-A_{0.5}-P_{0.5} original and after recycling five times.

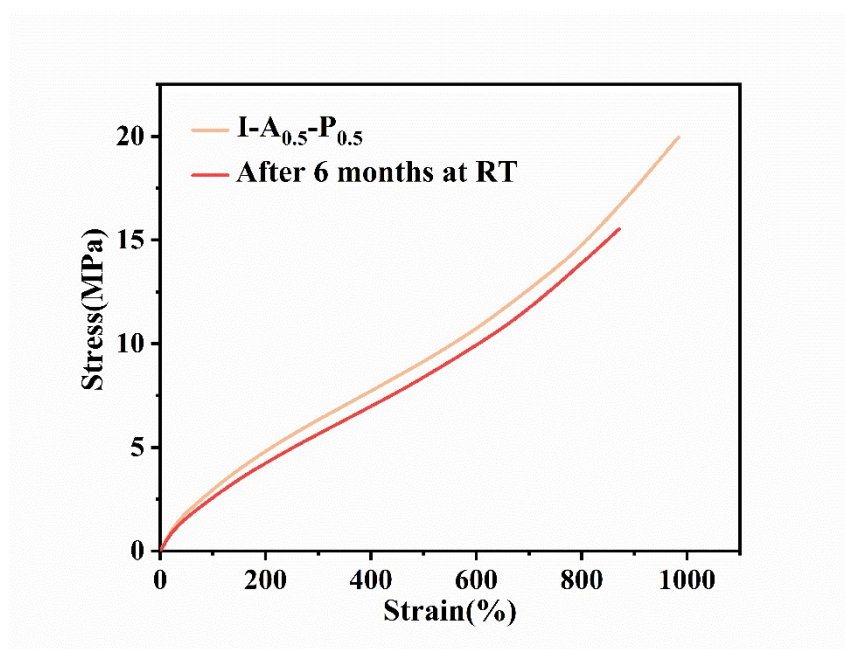


Fig. S8 The stress-strain curves of I-A_{0.5}-P_{0.5} original and after 6 months at RT.

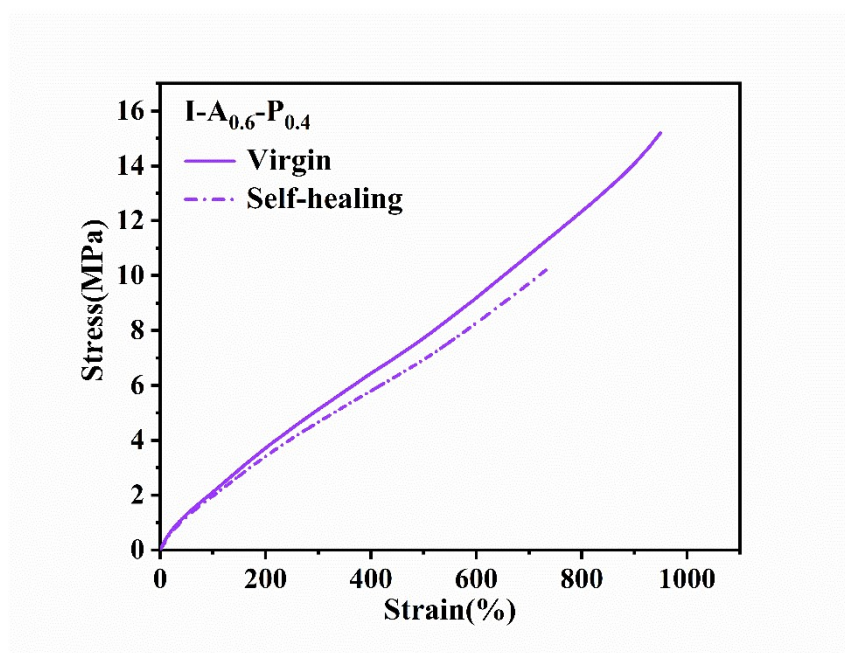


Fig. S9 The stress–strain curves of I-A_{0.6}-P_{0.4} original and the cut sample after self-healing at 80 °C for 6 h.

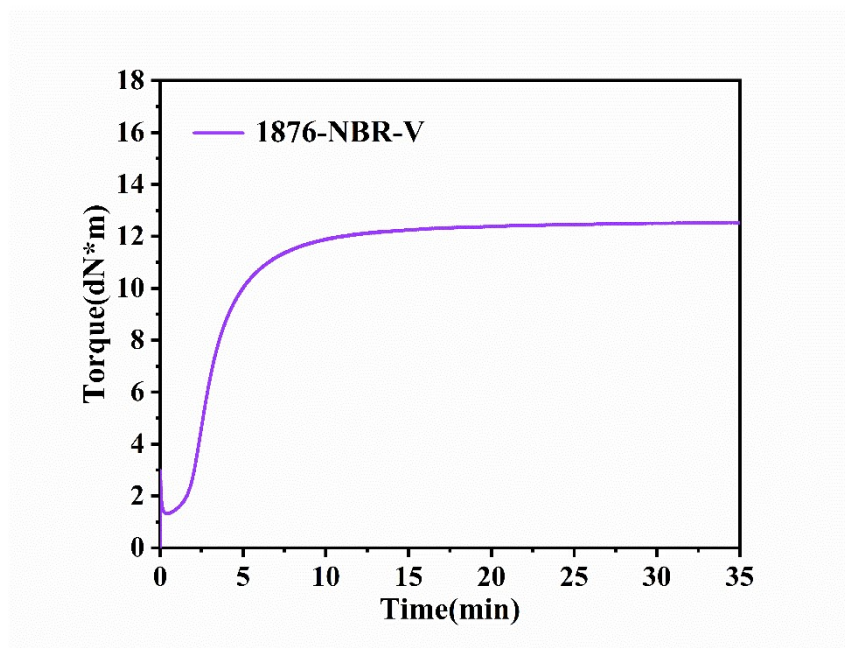


Fig. S10 Vulcanization curves of 1876-NBR-V.

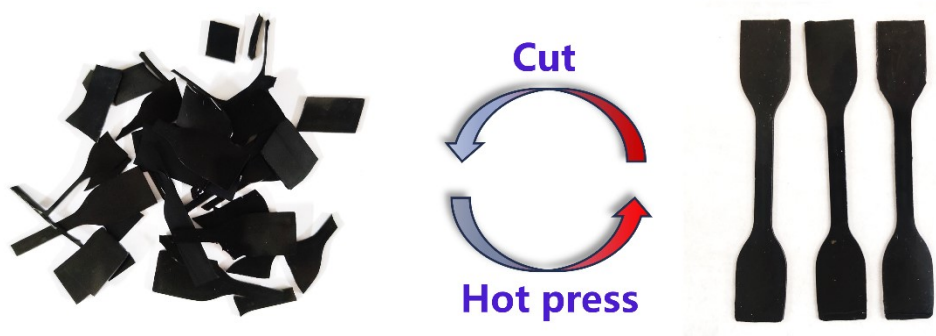


Fig. S11 Reprocessability of I-A_{0.5}-P_{0.5}-V