Electronic Supplementary Material (ESI) for RSC Advances.

SUPPORTING INFORMATION

Energetic Interpenetrating Polymer Network Based on Orthogonal Azido-Alkyne Click and Polyurethane for Potential Solid Propellant

Abbas Tanver,[a] Mu-Hua Huang,*[a] Yunjun Luo,*[a] Syed Khalid[a] and Tariq Hussain[b]

[a] School of Materials Science and Engineering, Beijing Institute of Technology, Beijing, 100081, China

[b] School of Mechatronical Engineering, Beijing Institute of Technology, Beijing, 100081, China

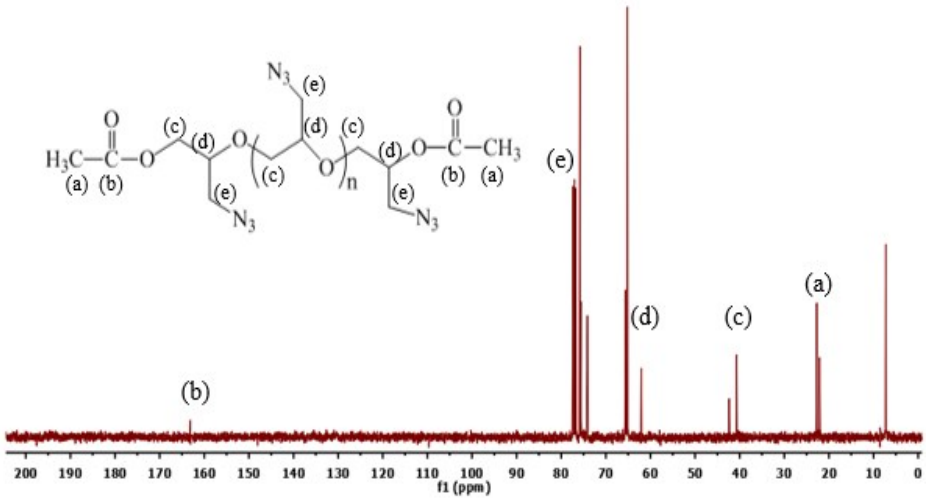

Figure S1: ^{13}C NMR of the Acyl-GAP

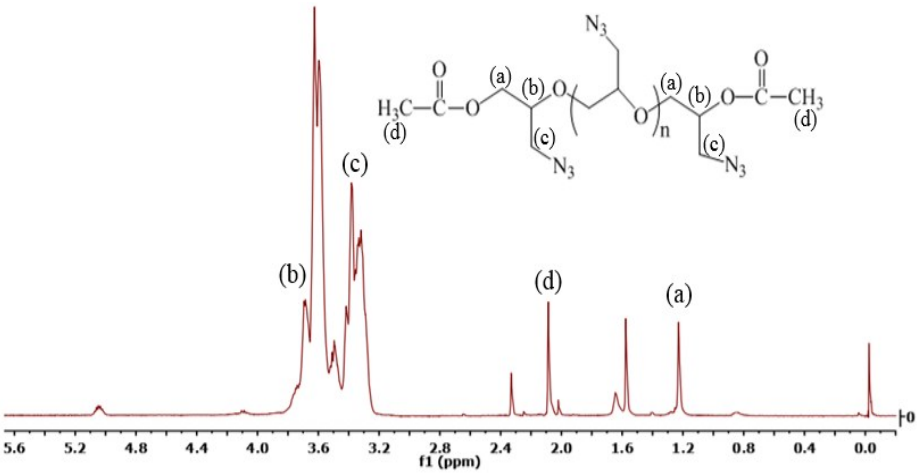

Figure S2: ^{1}H NMR of the Acyl-GAP

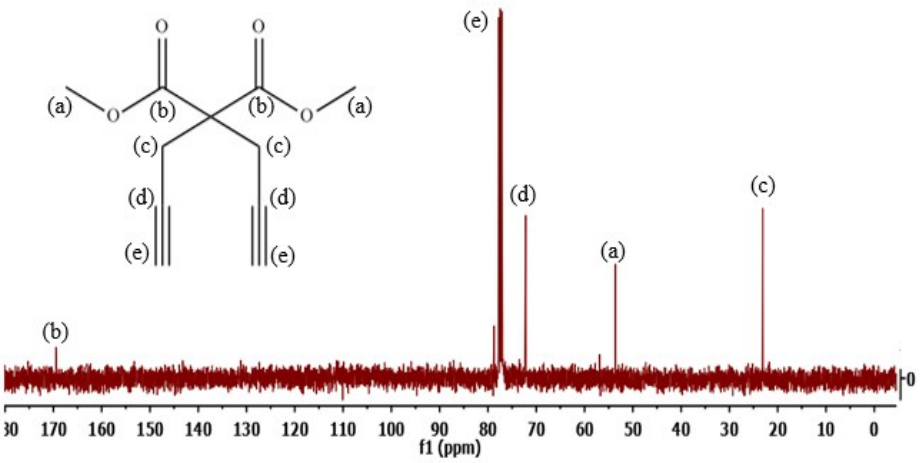

Figure S3: ^{13}C NMR of the DDPM

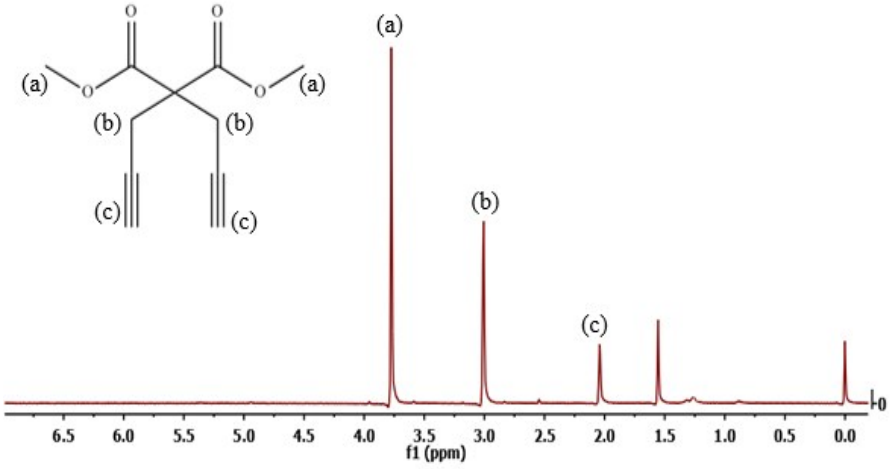

Figure S4: ^{1}H NMR of the DDPM

Table S1: GPC data of the GAP and Acyl-GAP

Sample	Mn (g/mol)	Mw (g/mol)	PDI (Mw/Mn)
GAP	4783	7193	1.504
Acyl-GAP	4825	7331	1.5193

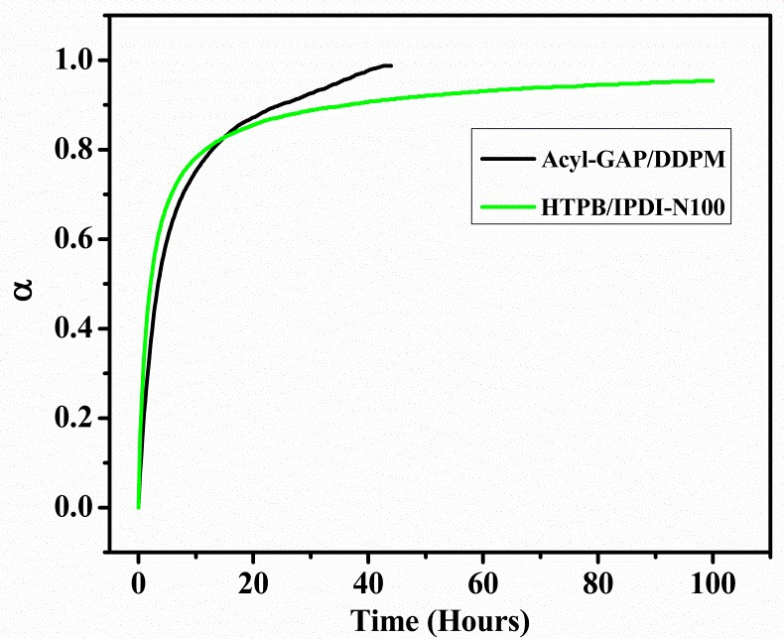

Figure S5: Conversion curves time for Acyl- GAP/DDPM and HTPB/IPDI-N100 at 60 ^{o}C

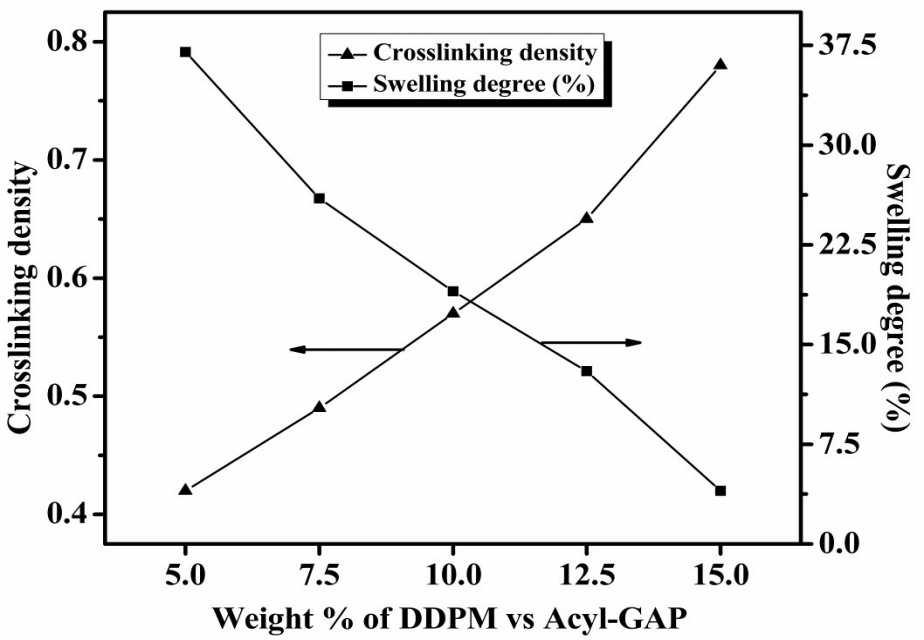

Figure S6: Effect of weight % of DDPM to Acyl- GAP on swelling degree and cross-linking density

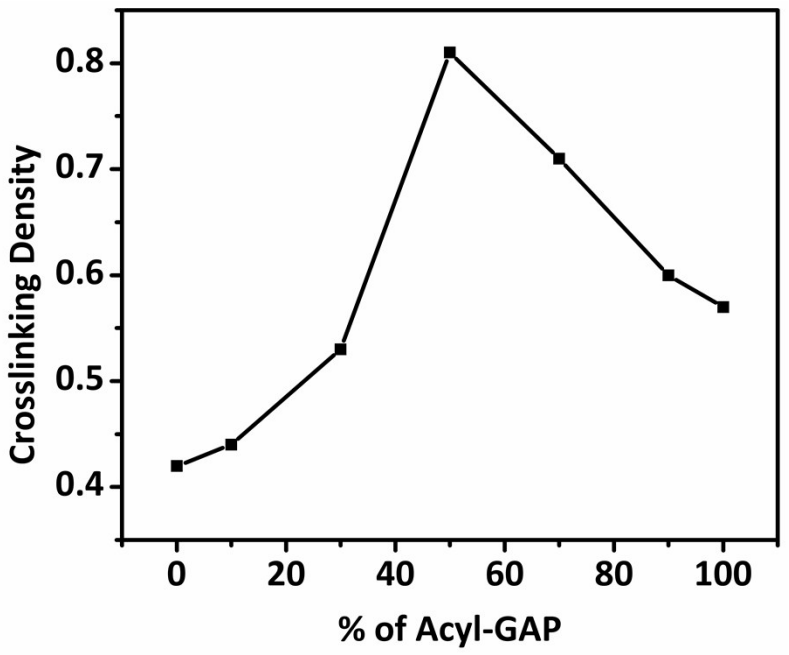

Figure S7: Effect of weight ratio of % Acyl-GAP vs HTPB on the cross-linking density

Table S2: DSC thermo grams data

Sample Code	Onset (°C)	Offset (°C)	Midpoint (T_g) (°C)
PU	-80.9	-73.53	-77.5
10% Acyl-GAP	-80.8	-72.5	-76.8
30% Acyl-GAP	-76.2	-69.1	-72.5
50% Acyl-GAP	-79.1	-72.0	-75.3
	-43.3	-28.1	-36.9
70% Acyl-GAP	-43.4	-29.5	-36.8
90% Acyl-GAP	-42.5	-28.8	-35.1
Triazole	-41.8	-28.1	-34.5

Table S3: Peak decomposition temperatures data of Acyl-GAP, single and IPN's

Sample Code	Onset exothermic decomposition tempersture (T_i, °C)		Peak decomposition temperature (T_d, °C)		Endothermic peak decomposition temperature ($T_e$pd, °C)
	T_1od	T_2od	T_1pd	T_2pd	
Acyl-GAP	213		250		
PU	298		365		458
10 % Acyl-GAP	213	277	248	364	458
30 % Acyl-GAP	210	279	253	366	461
50 % Acyl-GAP	208	277	252	368	462
70 % Acyl-GAP	210	280	251	366	459
90 % Acyl-GAP	211	275	248	365	458
Triazole	209		248		

***T_1*od**, first onset exothermic decomposition temperature; ***T_1*pd,** first peak exothermic decomposition temperature; ***T_2*od,** second onset exothermic decomposition temperature; ***T_2*pd,** second peak exothermic decomposition temperature; ***T_e*pd, °C,** endothermic peak decomposition temperature

Table S4: Impact, friction and ESD sensitivity data

Sample Code	Impact sensitivity (Joules)	Friction sensitivity (Newton)	Electrostatic discharge sensitivity ESD (Joules)
Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
PU	> 40 J	> 360 N	No ignition at 4.5 Joules
10 % Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
30 % Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
50 % Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
70 % Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
90 % Acyl-GAP	> 40 J	> 360 N	No ignition at 4.5 Joules
Triazole	> 40 J	> 360 N	No ignition at 4.5 Joules

Impact Sensitivity: Insensitive > 40 J, less sensitive ≥ 35 J, sensitive ≥ 4 J, very sensitive ≤ 3J
Friction Sensitivity: Insensitive > 360 N, less sensitive = 360 N, sensitive < 360 N to > 80 N, very sensitive ≤ 80 N, extreme sensitive ≤ 10 N.

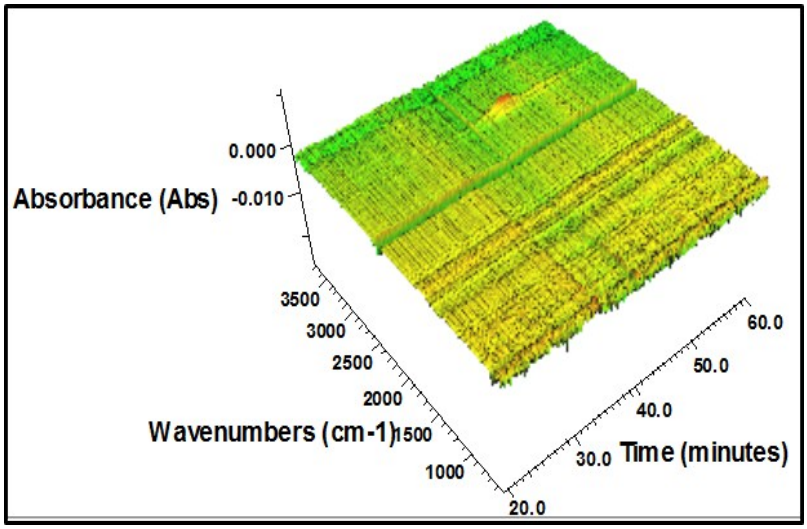

Figure S8 Three–dimensional TGA-FTIR of the decomposition products of 50:50 % Acyl-GAP/HTPB

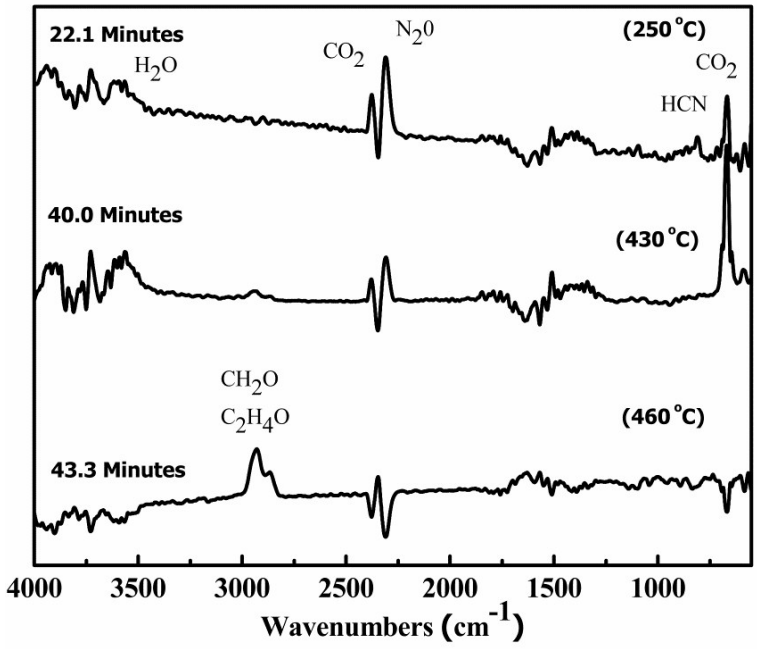

Figure S9: FTIR spectra of gas products during decomposition of 50:50 % Acyl-GAP/HTPB