A New Energetic Prepolymer

- Structurally Stable PGN Prepolymer -

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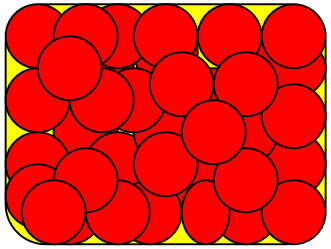
Plastic-Bonded Explosive(PBX)



Filler(High Explosive) 80~90 %

Binder(Polymer) 20~10 %

Inert Binder

High Performance or Low sensitivity

Energetic Binder

High Performance and Low sensitivity

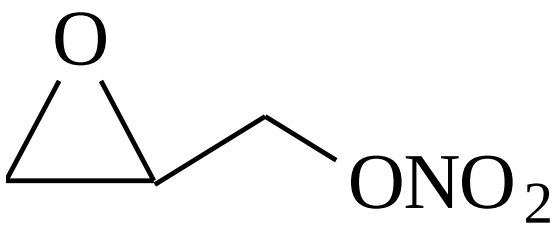
Nitrate, $-ONO_2$

Azide, $-N_3$

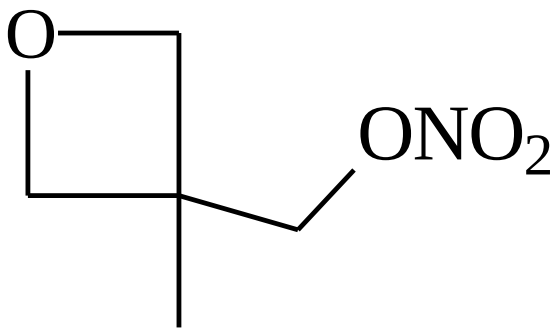
→

Nitro, $-NO_2$

Well-known monomers for energetic prepolymers

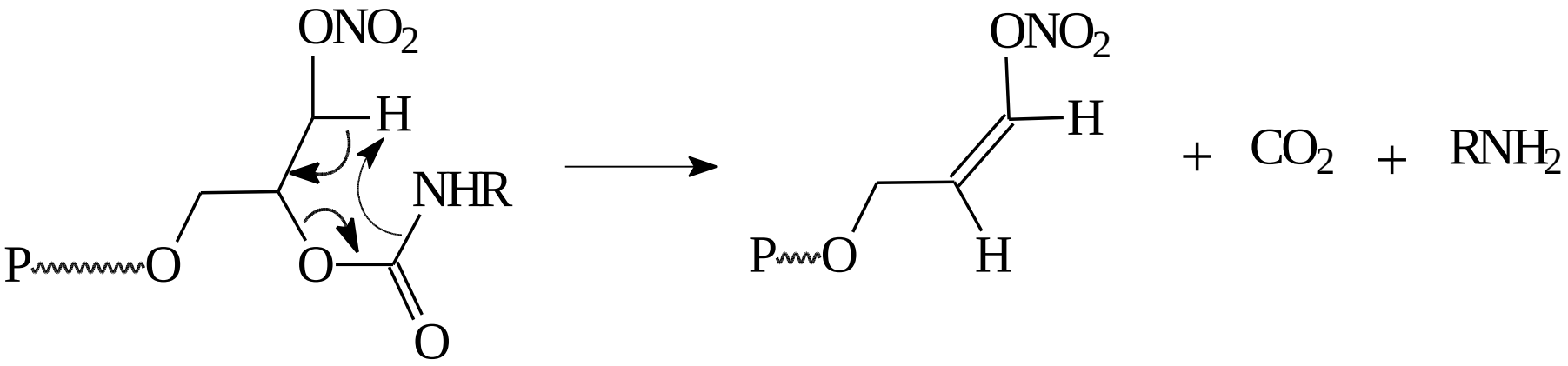


GN



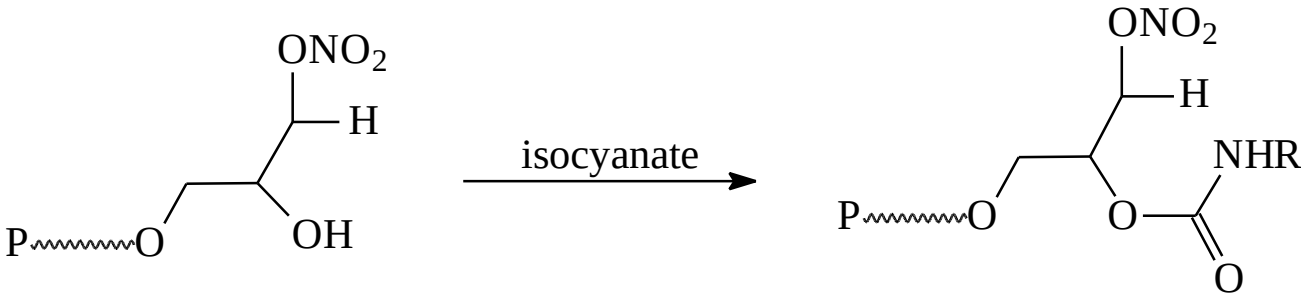
NIMMO

Chain scission of ETPE

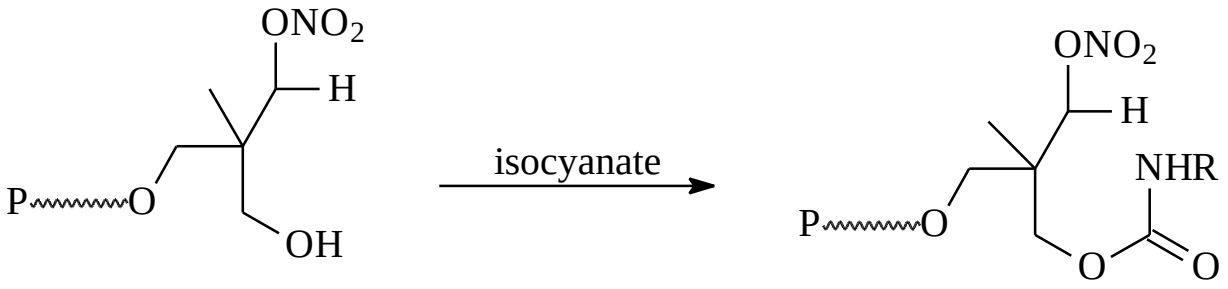


Chemical structure comparison of ETPE

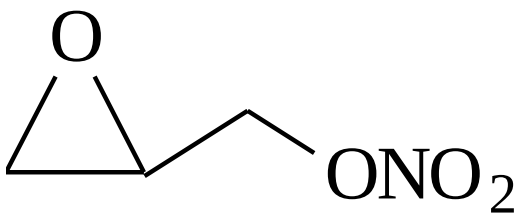
- **PGN**

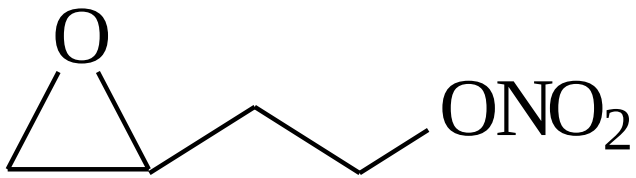


- **PNIMMO**



Design of new energetic monomer



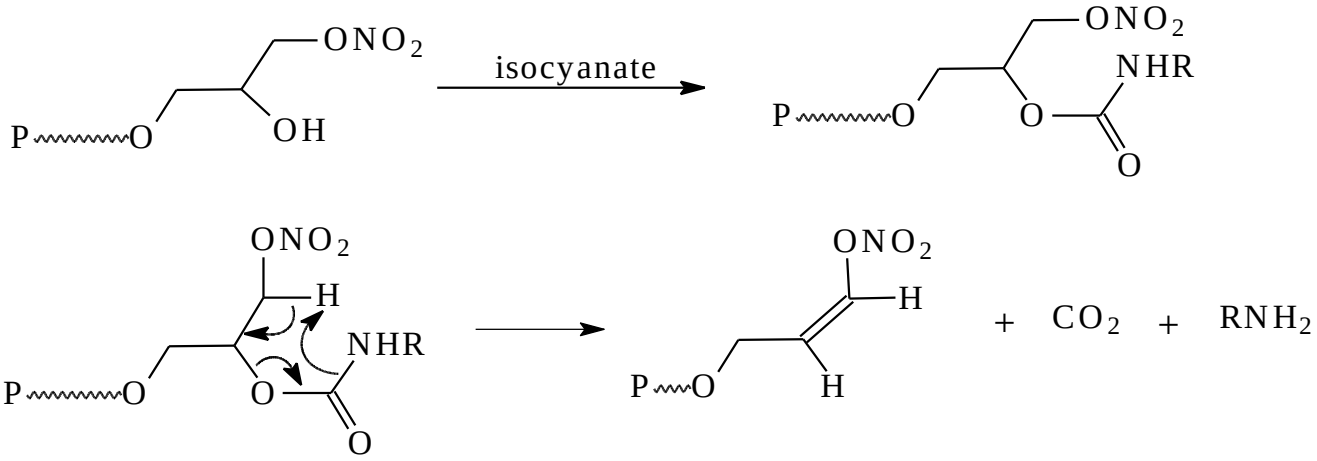


GN M-GN

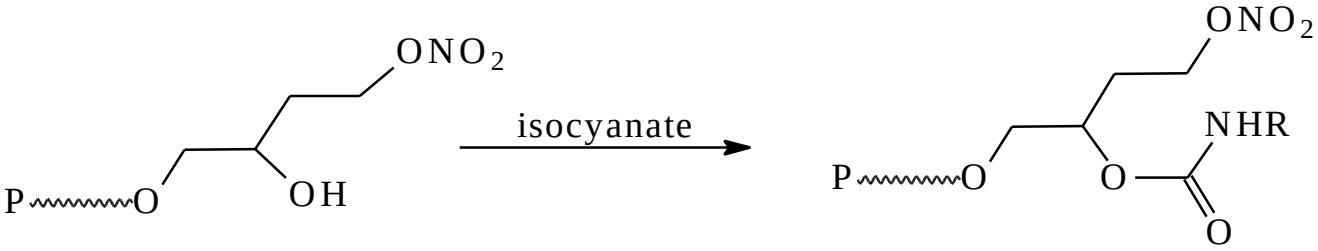
- Insert methylene group to GN
- 2-nitratoethyloxirane
  (we called it “M-GN”)

Prevent rearrangement reaction

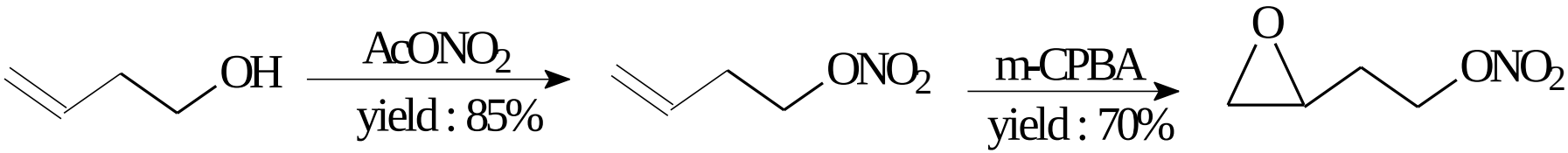
- PGN



- M-PGN

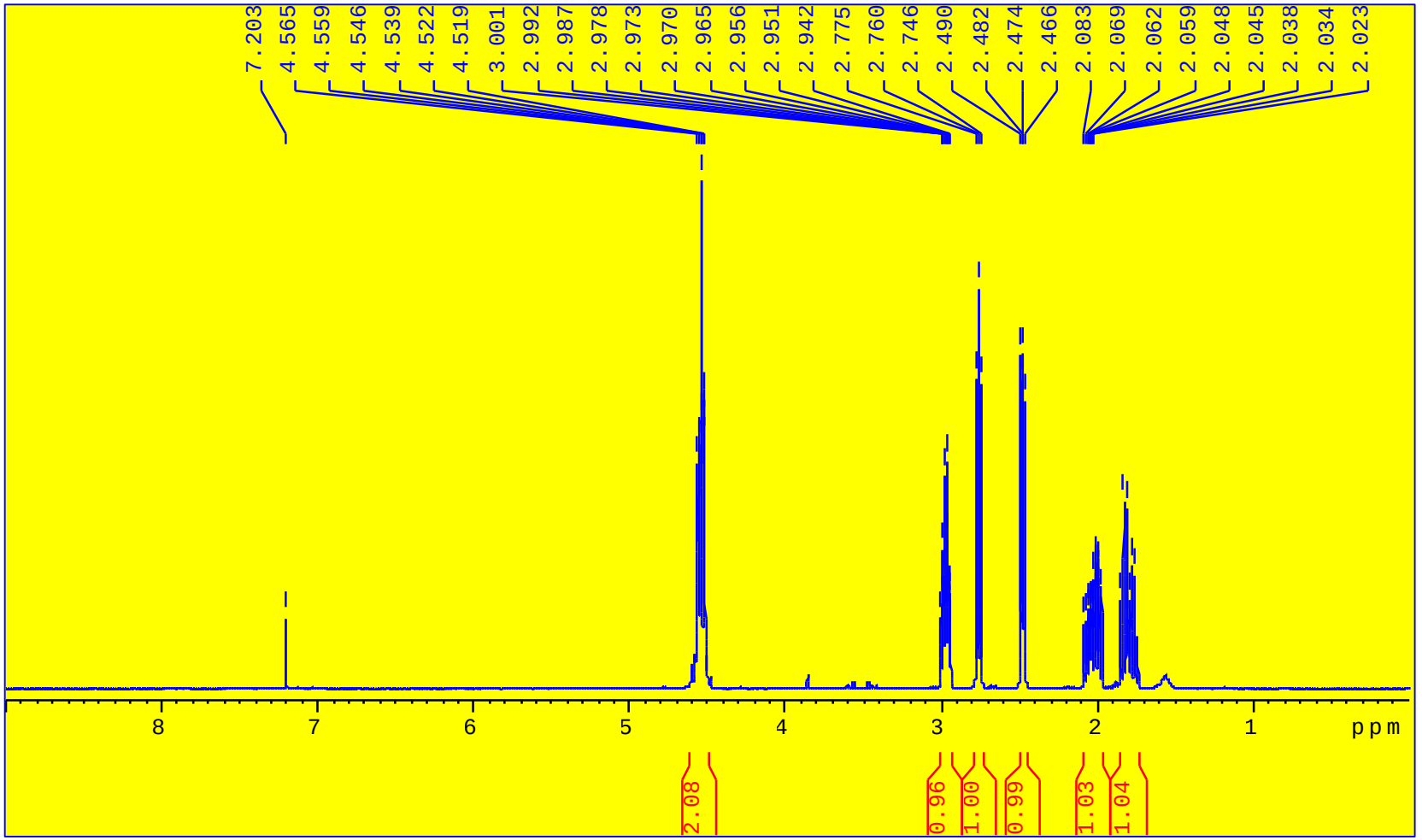


Synthesis of M-GN

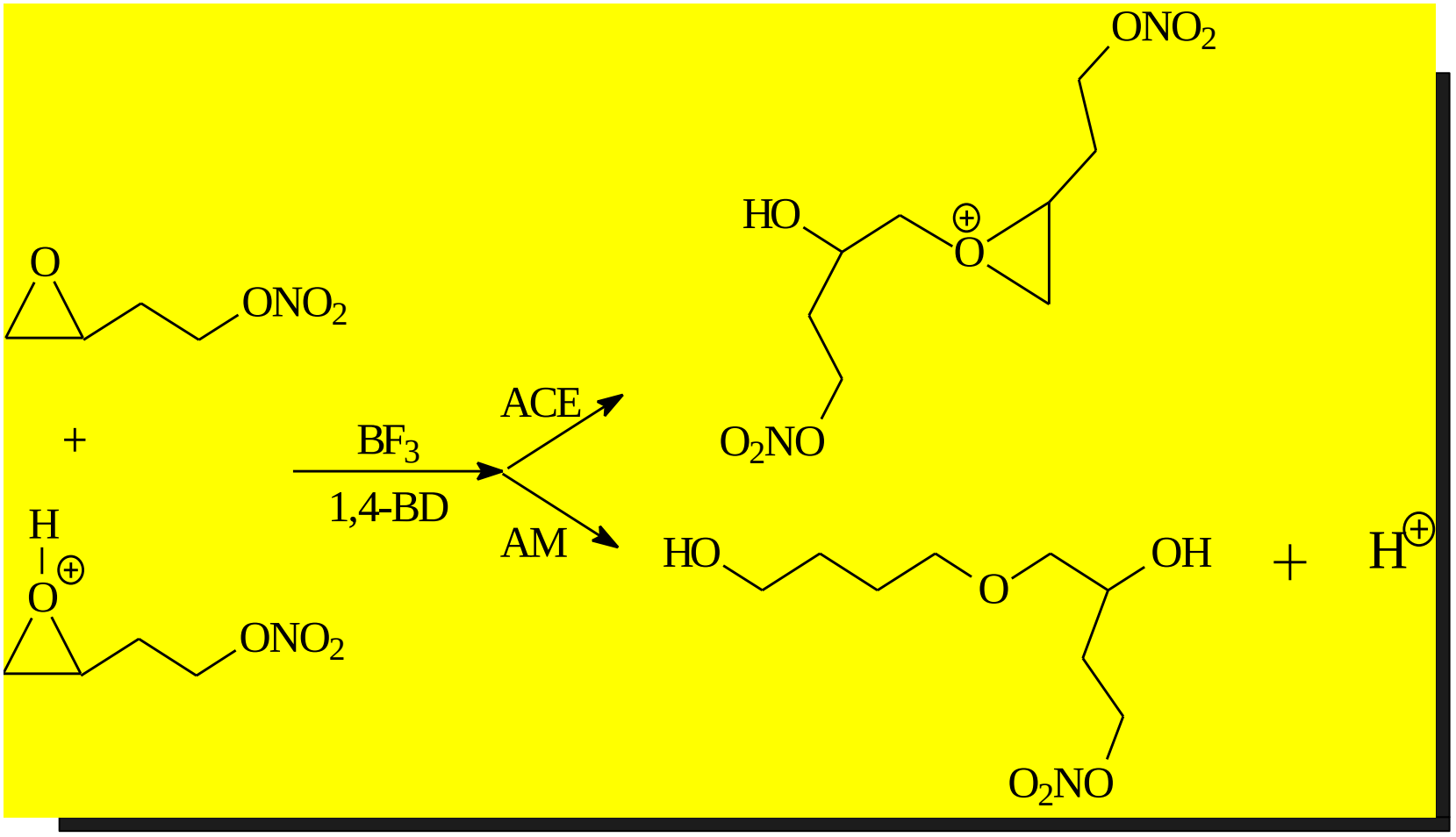


- Short reaction step
- Relatively high yield
- Mild reaction conditions

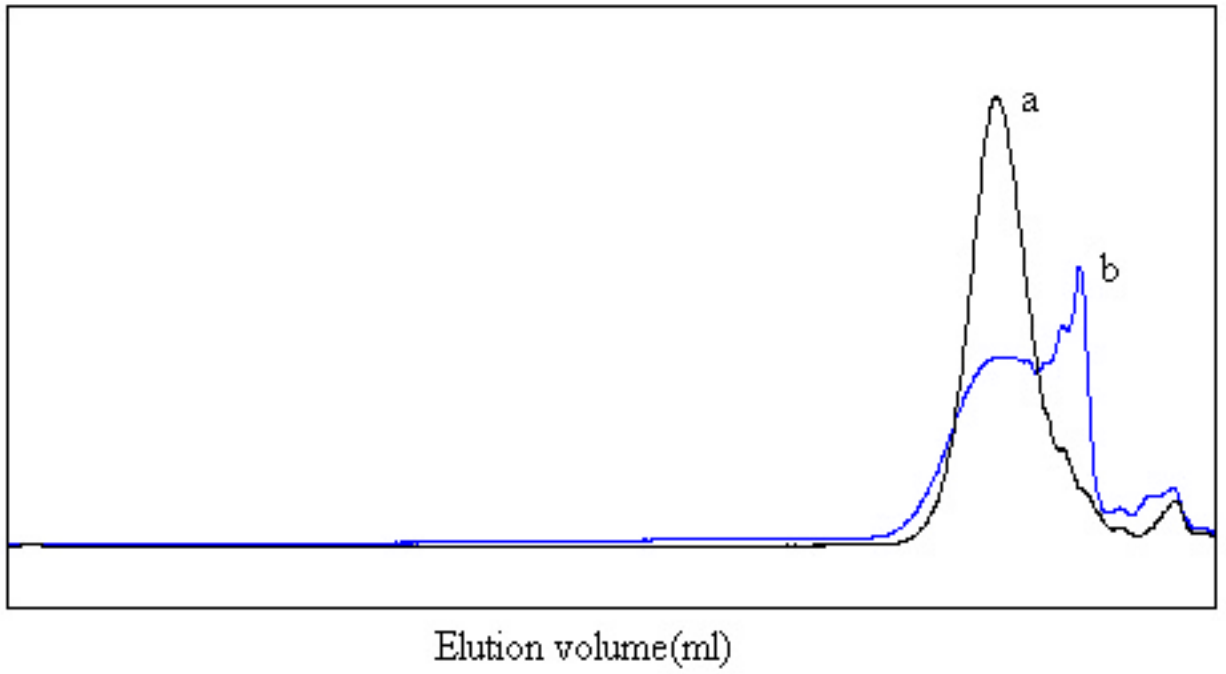
^{1}H-NMR Spectra of MGN



Activated monomer polymerization

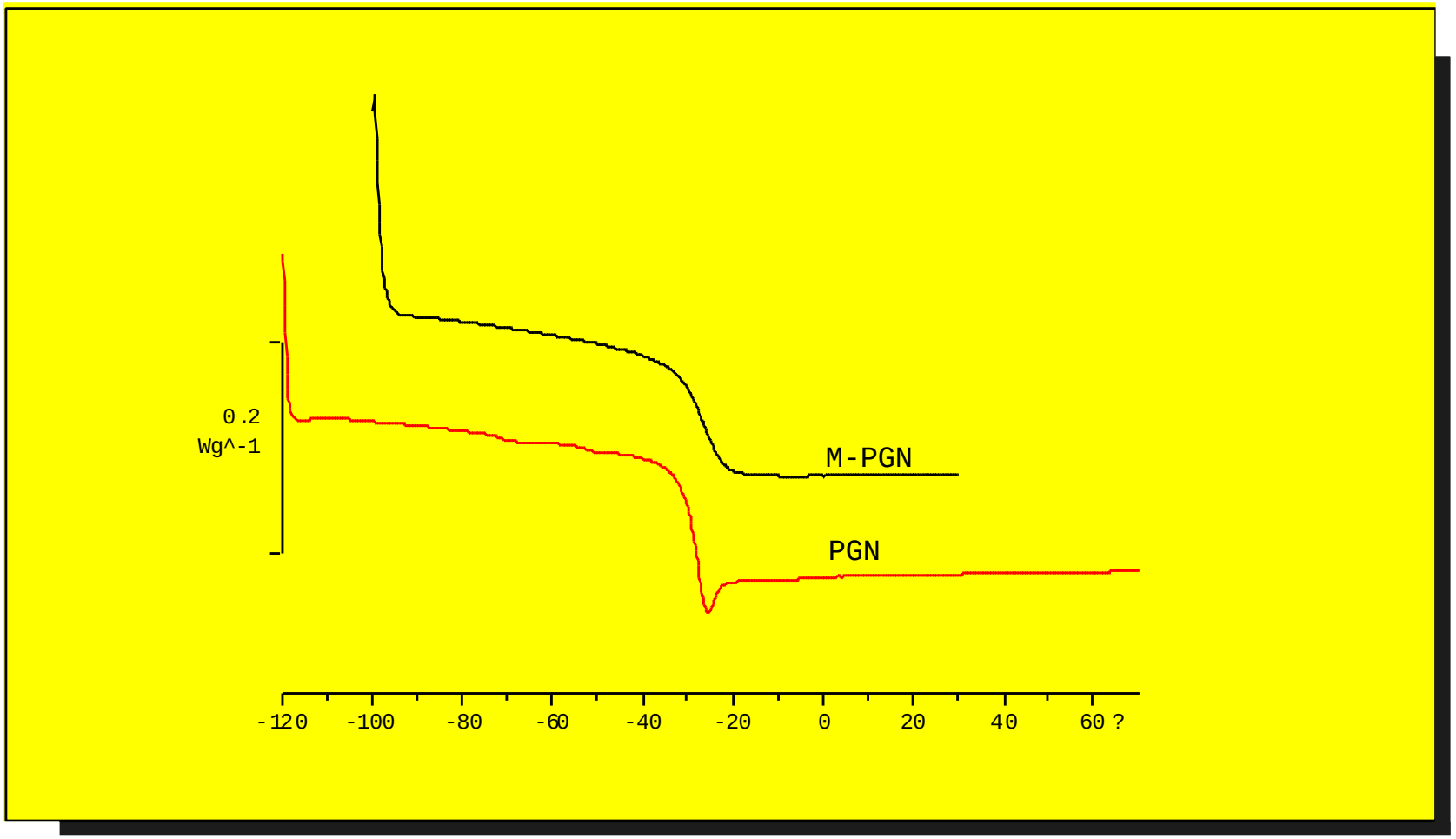


GPC chromatogram of M-PGN

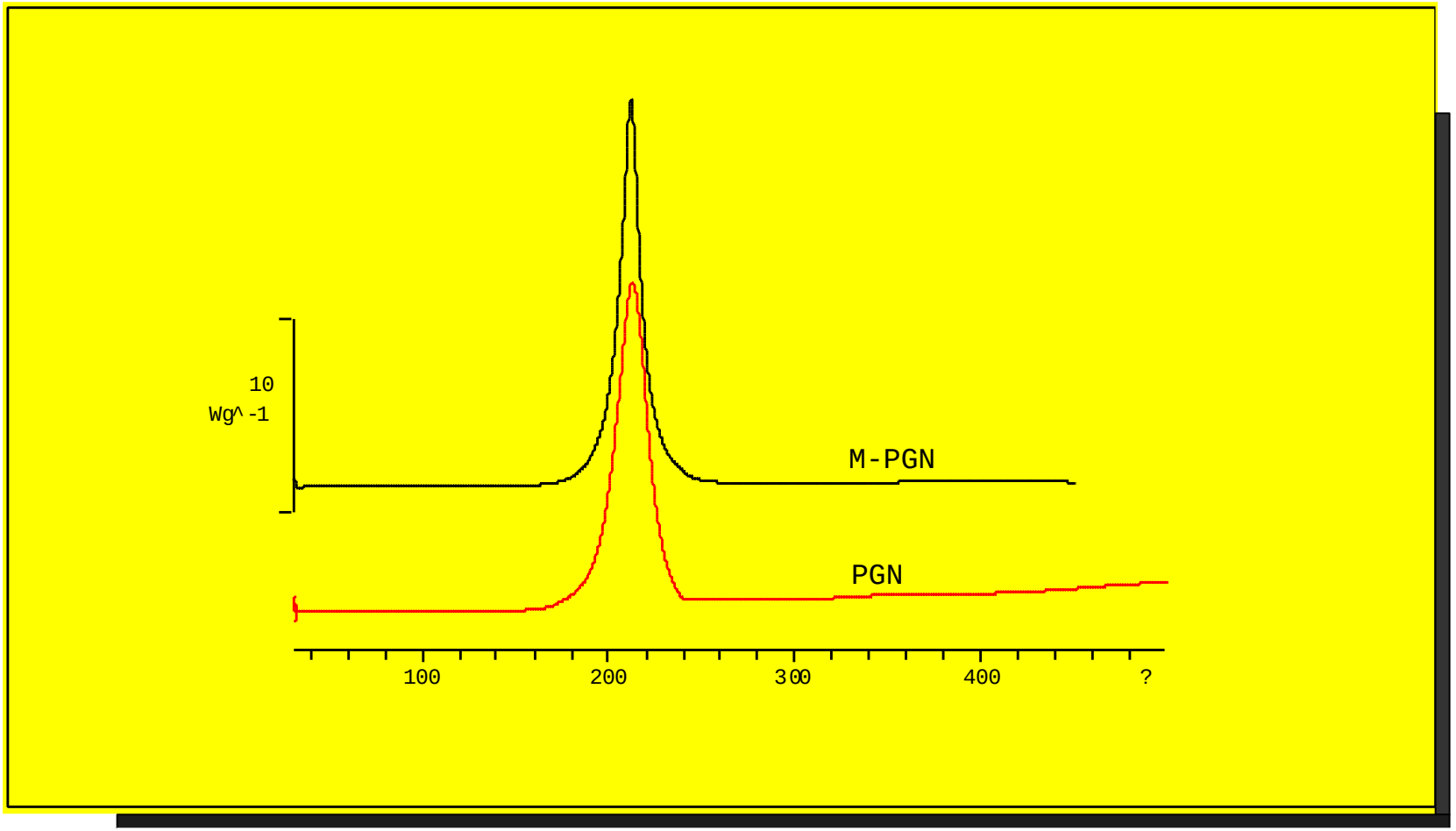


a) AM(Mn=2350, PDI=1.18), b) ACE(Mn=1870, PDI=1.42)

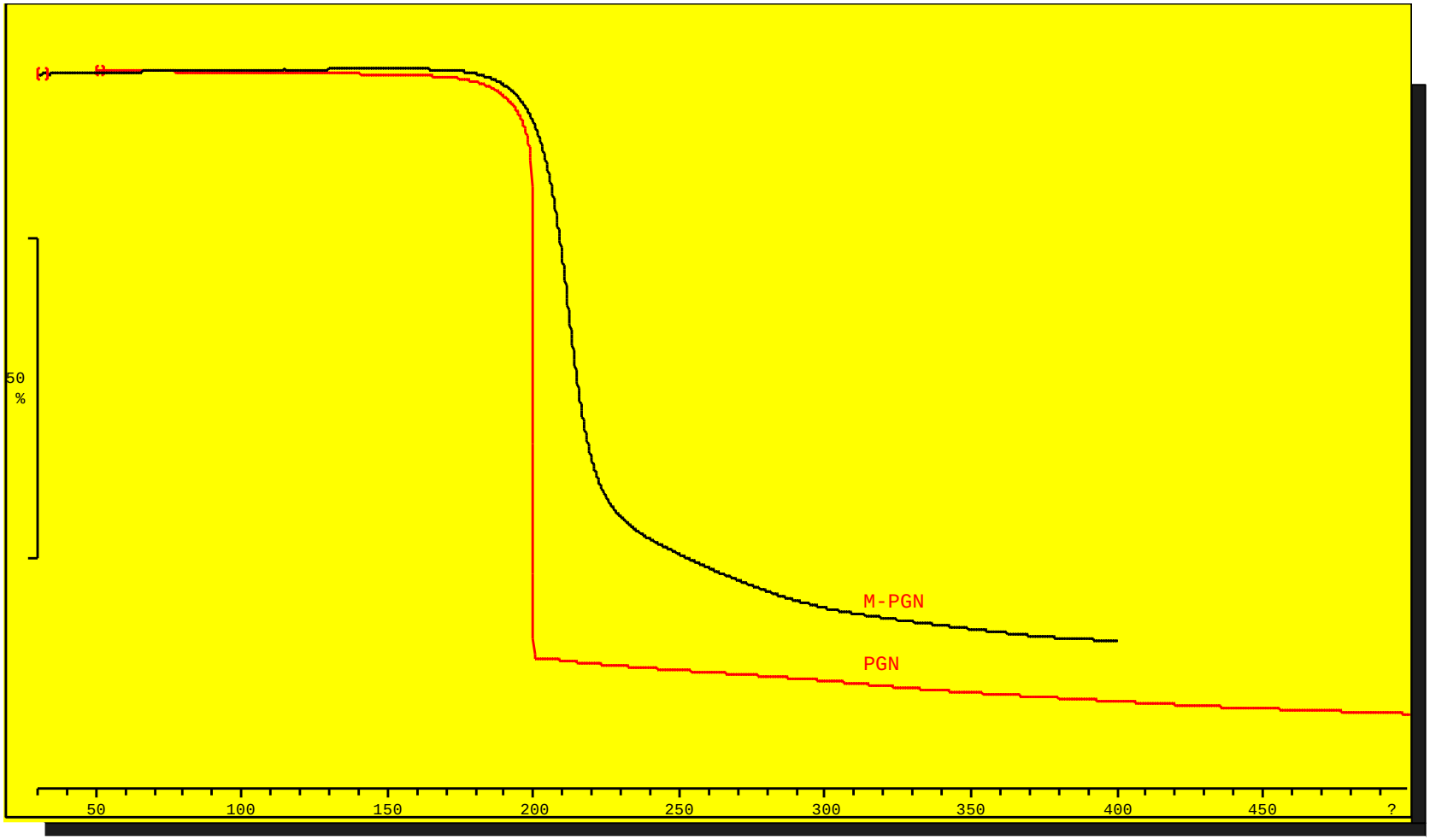
Glass transition temperature of PGN & M-PGN



Exothermic decomposition



TG thermogram of M-PGN



Comparison of physical properties

	PGN	M-PGN
Decomposition Onset(?)	180	>180
Tg (?)	-28.4	-28.0
Stability in polyurethane	unstable	stable

Viscosities

prepolymers	Tg(‘C)	Viscosity (at 25’C, poise)
PGN	-28.4	150
PNIMMO	-36.5	1200
M-PGN	-28.0	100

Changes of hardness for ETPE

Time(days)	Shore A hardness	
	PGN based	M-PGN based
3	2.0	2.0
5	3.0	3.0
7	2.5	3.5
10	decomposed	3.5
15		3.5
30		3.5
90		3.5
180		3.5

Conclusions

- We designed a new energetic monomer, 2-nitratoethyloxirane(M-GN)
- Simple process & Short steps
- Optimize polymerization process
- We confirmed dimensional stability of ETPE
- Bench scale production of M-PGN

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