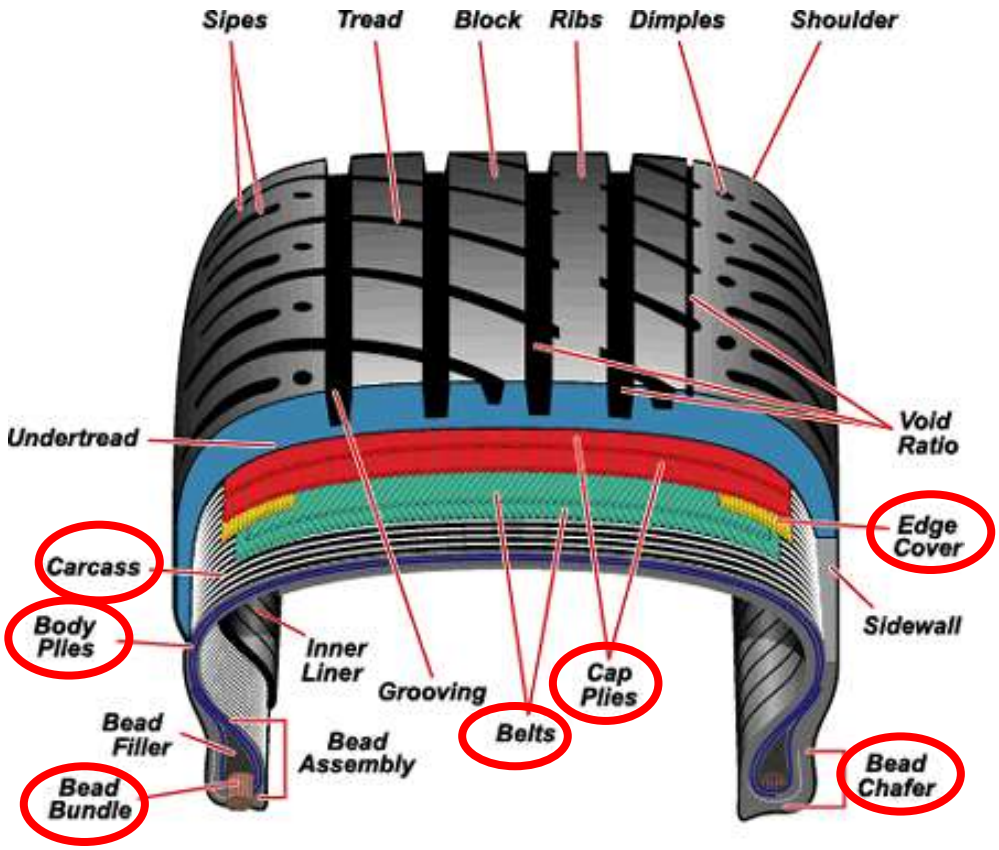





Amino

Adhesive resin AN220 product introduction

Product list



Product List

Product solutions according to customer requests：

Modified RF resin：AN220

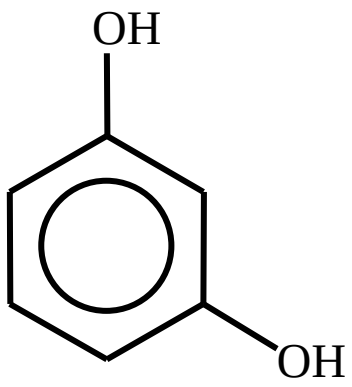
RF resin: AN2102，AN2102-2

Liquid resin: AN2101, AN2101-2

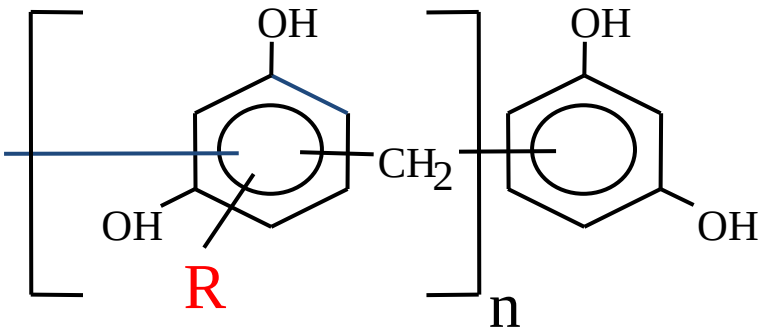
Phenolic adhesive resins

Chemical construction

Resorcinol



AN220

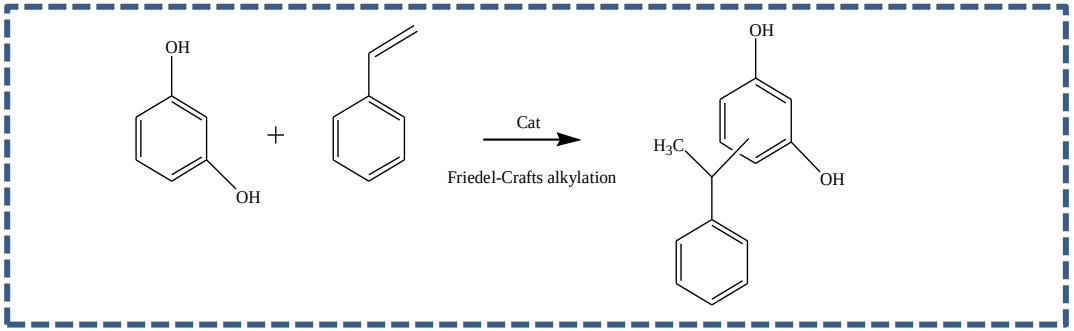


R = H or Hydroxyphenyl or Styrene

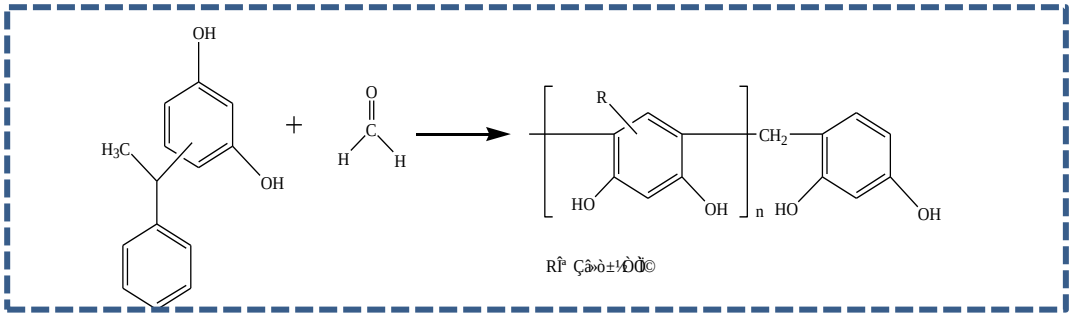
1. AN220 is a pre-condensation resin of resorcinol and formaldehyde .
2. Styrene modification can improve the hydrophobicity of AN220 .

Synthetic process

AN220 synthetic process



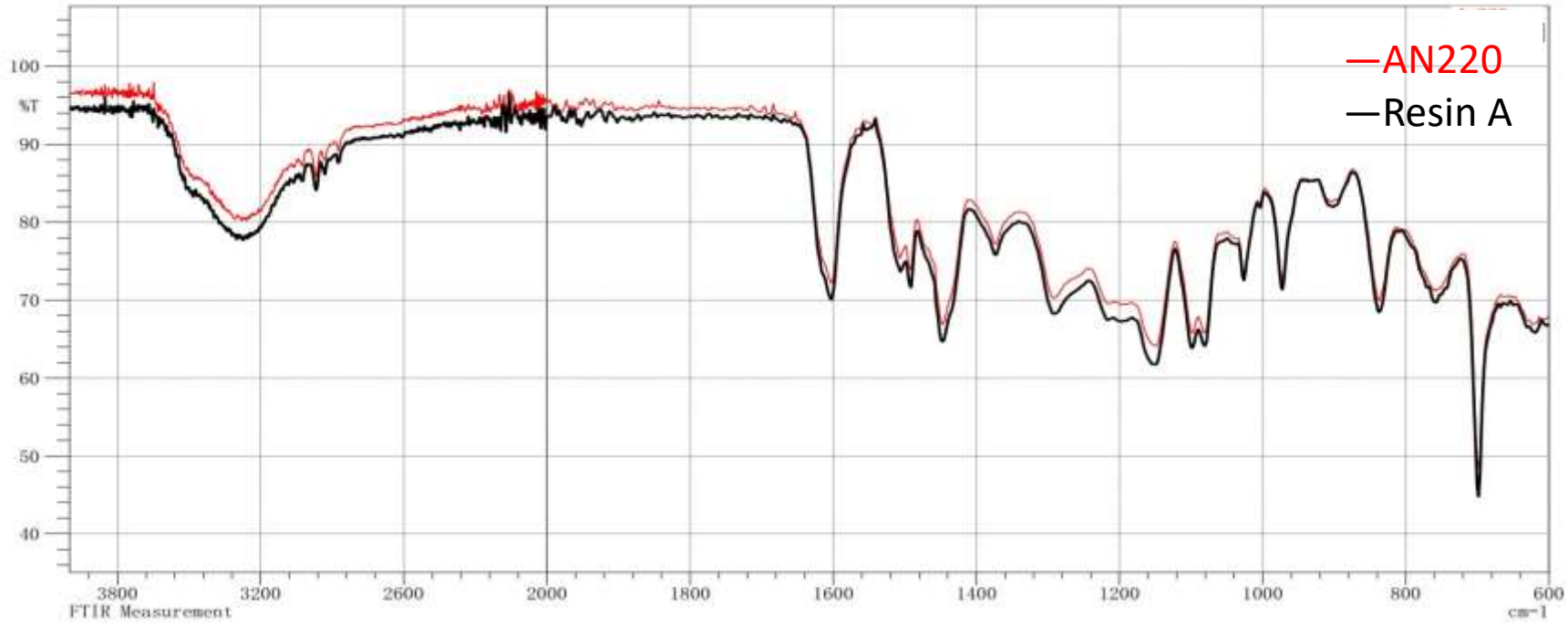
Alkylation



Polycondensation

Application tests

Infrared Spectroscopy (IR)



Resin A is styrene modified resorcinol formaldehyde resin.

Application tests

The Measurement Information

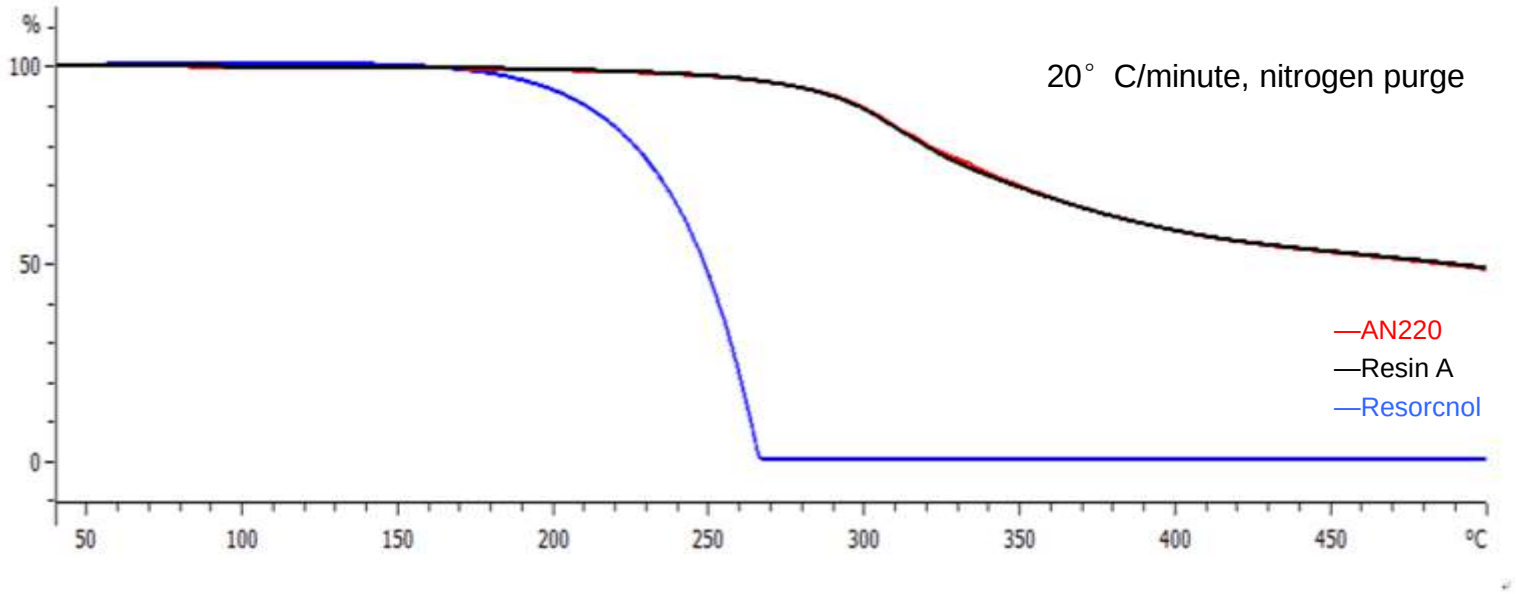
Properties	Resorcinol	AN220	Resin A
Appearance	White Flake	Reddish Brown Pastilles	Reddish Brown Pastilles
Softening Point (℃)	109.4*	104.5	103.2
Moisture Content (%)	0.07	0.20	0.15
Free Resorcinol (%)	100	1.55	1.83
pH (50% Aqueous Ethanol)	4.9	4.5	5.1
Specific Gravity (g/cm^3)	1.27	1.23	1.24

*Freezing Point

AN220 and Resin A will dramatically reduce the content of free resorcinol.

Application tests

Thermogravimetric Analysis (TGA) Weight Loss



The resin is more stable compare to pure resorcinol, due to the low free resorcinol content, less smoke is generated during rubber mixing process.

Application tests

Rubber Formulations			
Masterbatch	Resorcinol	AN220	Resin A
Nature Rubber	100.0	100.0	100.0
Carbon Black(N375)	42.0	42.0	42.0
Silica	10.0	10.0	10.0
Zinc Oxide	8.0	8.0	8.0
Antioxidant (6PPD)	2.0	2.0	2.0
Resorcinol	1.5		
Resin		2.0	2.0
Cobalt Salt (20.5%Co)	1.0	1.0	1.0
Final			
Insoluble Sulfur (80% active)	5.0	5.0	5.0
Accelerator (DCBS)	1.0	1.0	1.0
HMMM(65% active)	5.0	5.0	5.0
Total Parts	175.5	176.0	176.0

Application tests

Rubber Formulations

- The above rubber formulations are major used for the tire belt layer.
- Both resorcinol and RF resins require a methylene donor to completely crosslink.
- For steel cord adhesion we recommend HMMM (hexamethoxymethylmelamine) as the methylene donor.
- We don’t recommend HMTA (hexamethylenetetramine) for steel cord adhesion. HMTA will damage steel cord.

Application tests

Compound Properties

	Resorcinol	AN220	Resin A
Mooney viscosity (100℃)			
$M_{L(1+4)}$	63	64	62
Mooney scorch (127℃)			
t5,min	13.7	17.6	17.7
MDR Rheometer Cure (150℃)			
MH,dNm	32.1	28.2	27.6
ML,dNm	2.4	2.4	2.2
Ts2,min	2.3	3.5	3.6
T10,min	3.0	4.0	4.1
T50,min	5.6	7.2	7.3
T90,min	13.1	16.0	16.1

Application tests

Compound Properties

Steel cord Adhesion, 12.5mm Embedment, Wire: 3x0.2+6x0.35 mm,
63.5% Copper Newtons (% Rubber Coverage)

	Resorcinol	AN220	Resin A
Unaged	895 (90)	1018 (90)	999 (90)
Steam Age 48 hours，120℃	293 (30)	516 (50)	547 (50)
Salt Water Age 5 days，17%NaCl	903 (90)	970 (90)	974 (90)
Heat Age 48 hours，100℃	889 (95)	922 (95)	890 (95)
Humidity Age 7 days，70℃/85%RH	790 (85)	834 (90)	838 (90)

The samples were vulcanized at 150℃ for 30 minutes.

Application tests

Compound Properties

Physical Properties	Resorcinol	AN220	Resin A
Tensile Strength，MPa	25.4	25.7	25.2
Elongation to Break，%	388	402	399
50% Modulus，MPa	2.5	2.5	2.5
100% Modulus，MPa	4.8	4.6	4.6
300% Modulus，MPa	19.8	18.9	19.1
Die C Tear，kN/m	53	59	52
Hardness（Shore A）	80	80	80

The samples were vulcanized at 150℃ for 20 minutes.

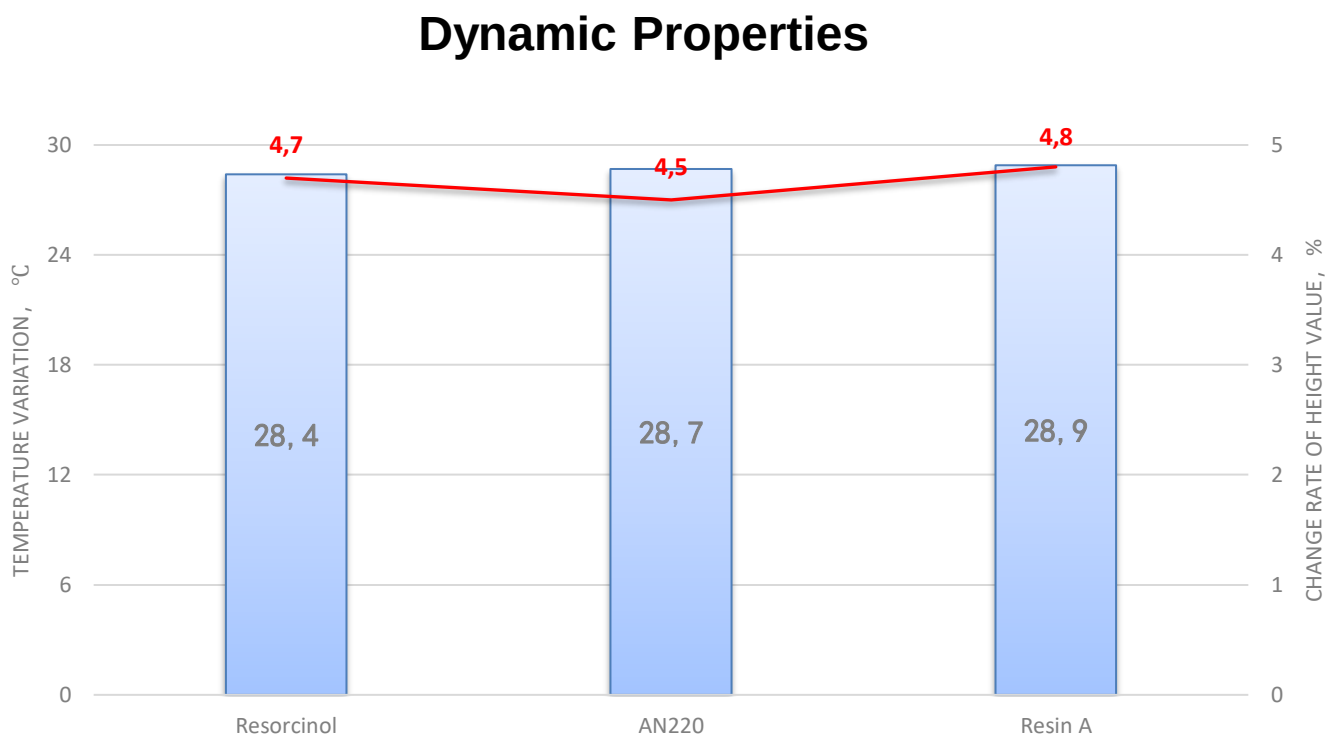
Application tests

Compound Properties

Physical Properties	Resorcinol	AN220	Resin A
Tensile Strength， MPa	11.7	11.3	11.8
Elongation to Break，%	127	130	132
50% Modulus， MPa	4.9	4.5	4.6
100% Modulus， MPa	9.3	8.6	8.7
Die C Tear， kN/m	25	23	27
Hardness（Shore A）	88	87	87

The vulcanized samples were aged at 100℃ for 48 hours.

Application tests



The hysteresis loss was characterized by Goodrich Flexometer.

Application tests

Conclusions

1. AN220 is an environmentally friendly resin (less smoke) and easy to handle in production site (no caking issue).

2. Compared with resorcinol, AN220 enable rubber compound to have a better performance in processing safety.

3. Compared with resorcinol, AN220 enable rubber compound to have better comprehensive adhesive properties, especially water resistance.

4. Compared with resorcinol, the mechanical properties and dynamic properties of rubber compound almost no change when AN220 is used.

5. AN220 is equivalent to resin A and almost have the same properties.

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OUR VISION

To create a market-driven, self- realized, globalized chemical company based on the pursuit of continuous innovation and responsible care.