Effect of polydimethylsiloxane and polyol molecular weight On properties of polyurethane

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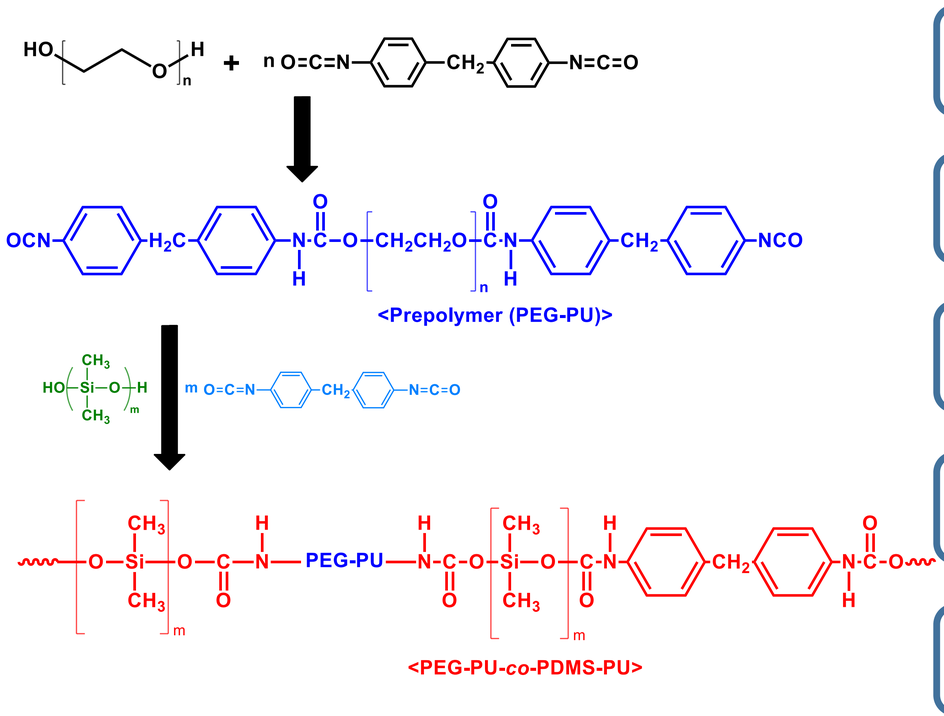
Abstract

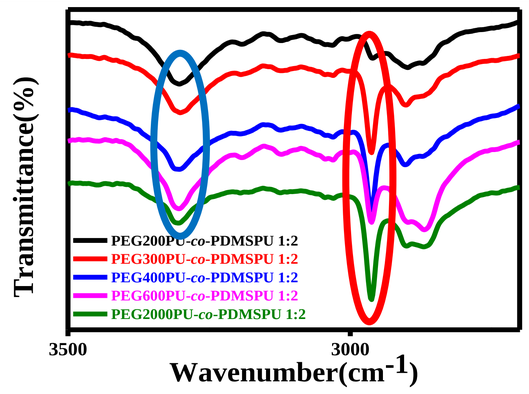
Polydimethylsiloxane-polyurethane(PDMS-PU) was synthesized using MDI, polyethylene glycol and these types of siloxane polyol. The dependance of siloxane molecular weight on the mechanical and surface properties was confirmed by UTM and contact angle and SEM. PDMS-rich phase at the polymeric surface enhanced the increase in hydrophobicity. Contact angle of PDMS-PU was increased with increasing PDMS molecular wieght. The hydrophobic effect of PDMS blocks in PDMS-PU matrix control level to the potential water-barrier property. The optical transmittance and water vapor transmission rate of PDMS-PU were also investigated to use as an encapsulation material for the environmental protection and industrial applications

Experiment

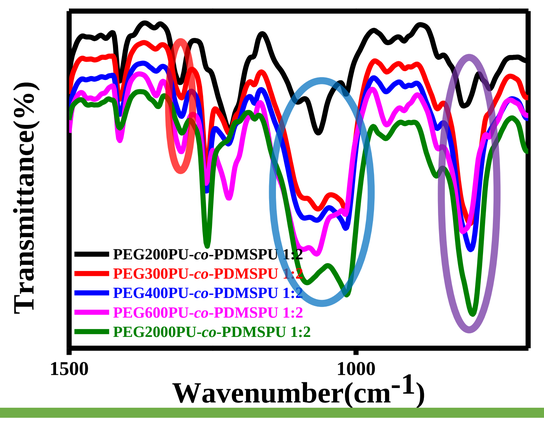


Prepolymer (MDI+PEG)
60 ℃, 3hr
Added of PDMS 550 $\overline{Mn}$
60 ℃, 1hr
Added 2nd MDI
70 ℃, 6hr
Precipitating with Water and EtOH
Room temp
Drying sample (on dry oven 60℃)

FT-IR

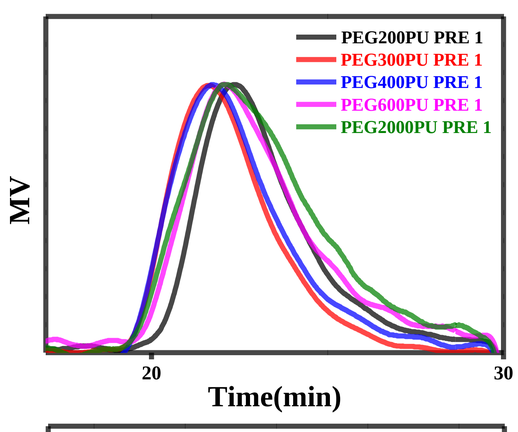


Functional group	Wave number
$-NH_2$	3300
-CO	2880

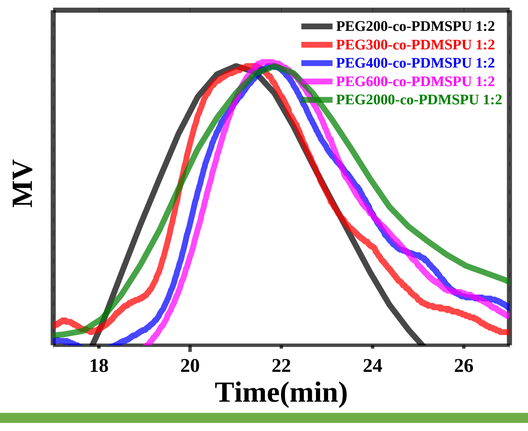


Functional group	Wave number
CH_3 sy. bending	1252
Si-O-Si	1052
CH_3 rocking	790

GPC

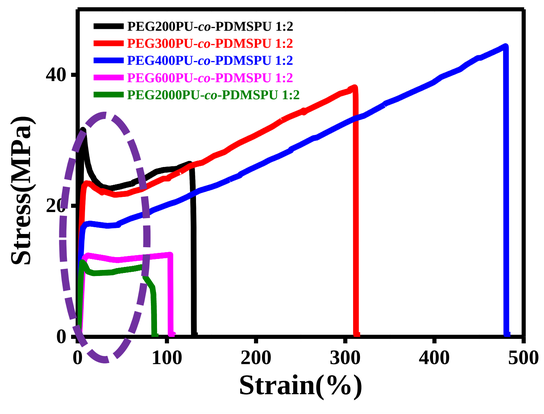


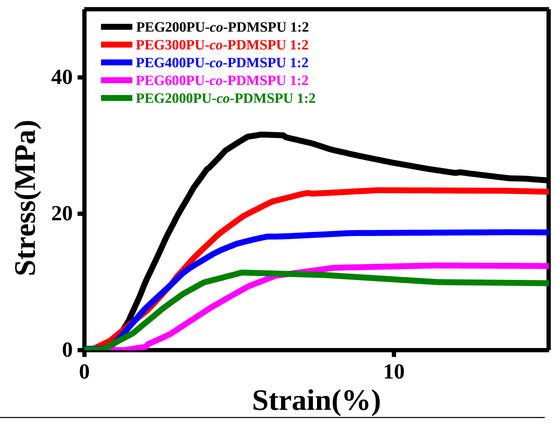
Sample	$\overline{Mn}$
PEG200PRE 1	43293
PEG300PRE 1	55506
PEG400PRE 1	58116
PEG600PRE 1	56534
PEG2000PRE 1	43602



Sample	$\overline{Mn}$
PEG200-*co*-PDMSPU 1:2	76138
PEG300-*co*-PDMSPU 1:2	75776
PEG400-*co*-PDMSPU 1:2	78569
PEG600-*co*-PDMSPU 1:2	71869
PEG2000-*co*-PDMSPU 1:2	73702

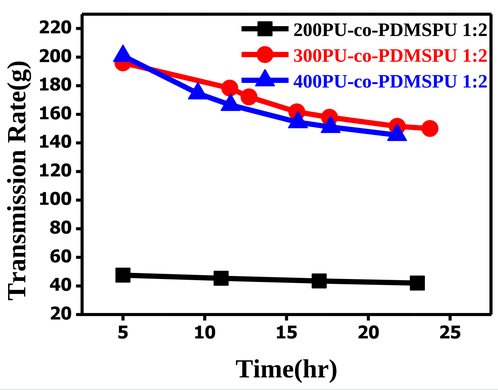
UTM





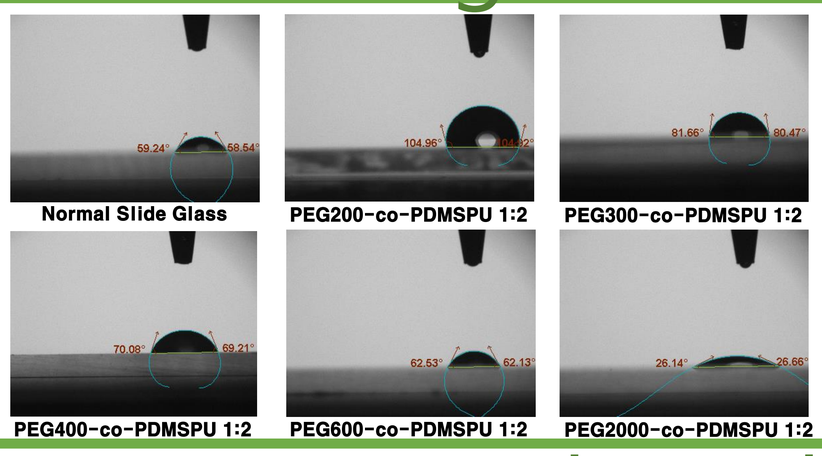
Sample	Stress (Mpa)	Young's Modulus
PEG200-*co*-PDMSPU 1:2	30.69	1141.30
PEG300-*co*-PDMSPU 1:2	37.411	564.14
PEG400-*co*-PDMSPU 1:2	43.697	523.22
PEG600-*co*-PDMSPU 1:2	12.369	513.15
PEG2000-*co*-PDMSPU 1:2	10.408	381.00

WVTR



Sample	TR(g)
PEG200PU-*co*-PDMSPU 1:2	43.53714
PEG300PU-*co*-PDMSPU 1:2	150.084
PEG400PU-*co*-PDMSPU 1:2	145.4596
PEG600PU-*co*-PDMSPU 1:2	FAIL(>250)
PEG2000PU-*co*-PDMSPU 1:2	FAIL(>250)

Contact Angle



Sample	Contact Angle
PEG200PU-*co*-PDMSPU 1:2	104.96
PEG300PU-*co*-PDMSPU 1:2	81.66
PEG400PU-*co*-PDMSPU 1:2	70.08
PEG600PU-*co*-PDMSPU 1:2	62.53
PEG2000PU-*co*-PDMSPU 1:2	25.14

Conclusion

1. The successful synthesis of PEG-PDMS-PU using both PEG and PDMS blocks as soft segments
2. The good water barrier property of PEG200-PDMS-PU due to flat molecular packing structure
3. The high contact angle caused rich hydrophobic phase by many urethane groups.
4. The high Young's modulus of PEG200-PDMS-PU due to the strong H-bonding

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