

 Shell Chemicals

# Carilon

Thermoplastic Polymers

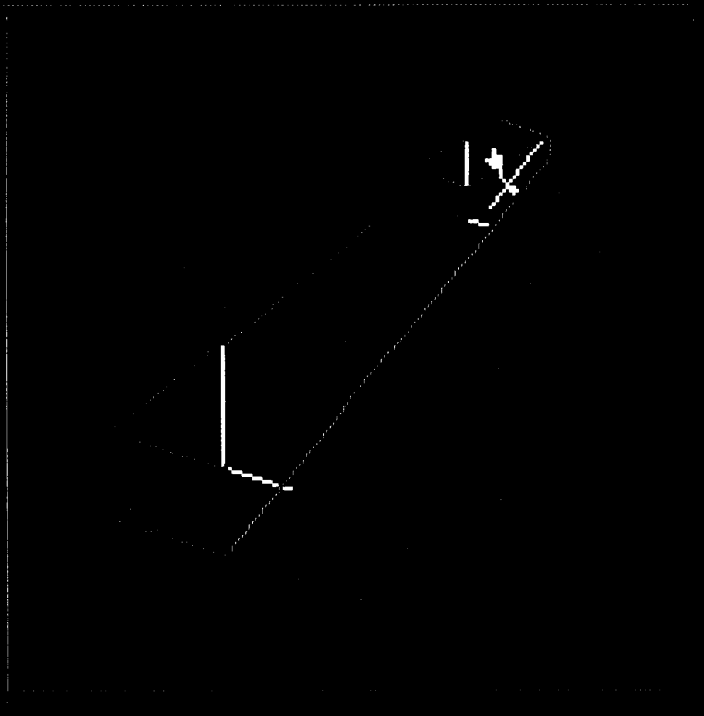
EXPAND YOUR HORIZONS

## Snap Fit Assemblies

CARILON is a Shell trade mark

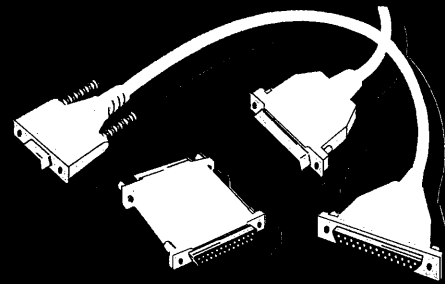
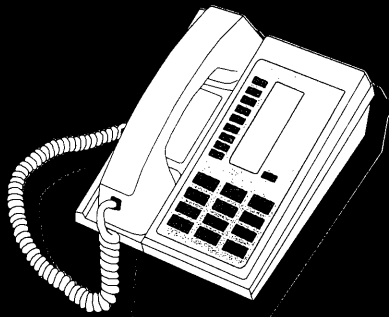
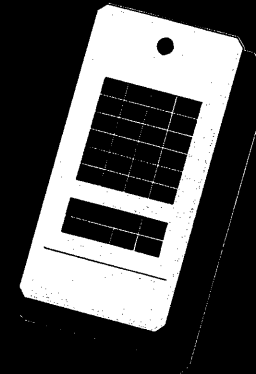
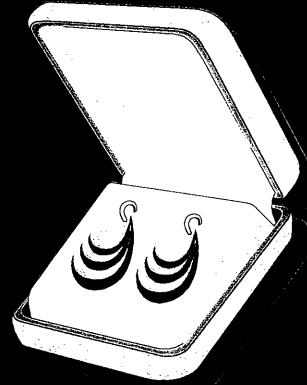
**Carilon**  
Thermoplastic Polymers

# Introduction



- Easy assembly method
- No need for assembly tools
- Snap fit is moulded with part
- Fast assembling
- Cost effective

# Different Snap Fit assemblies

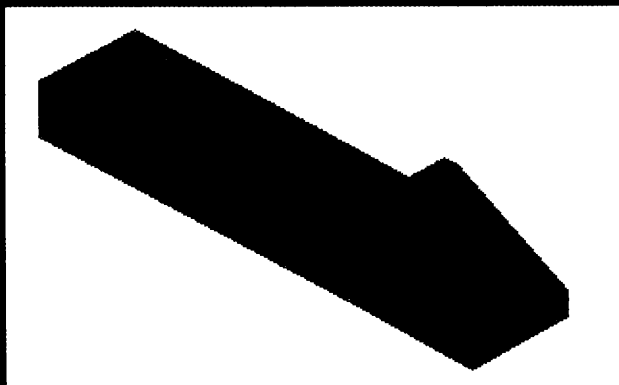


# A designer's view

Insertion Force

Water in-sensitivity

Repeatability



Retention force

Chemical resistance

Flexibility

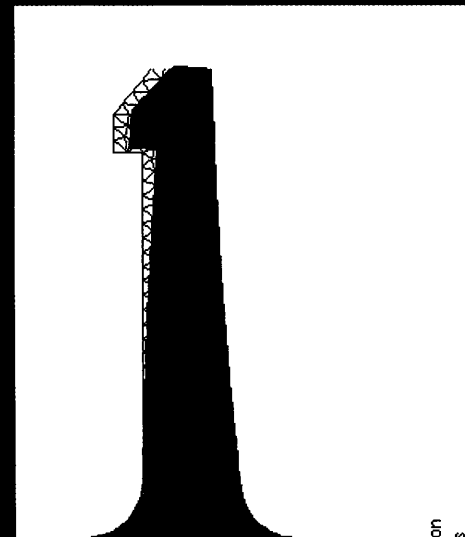
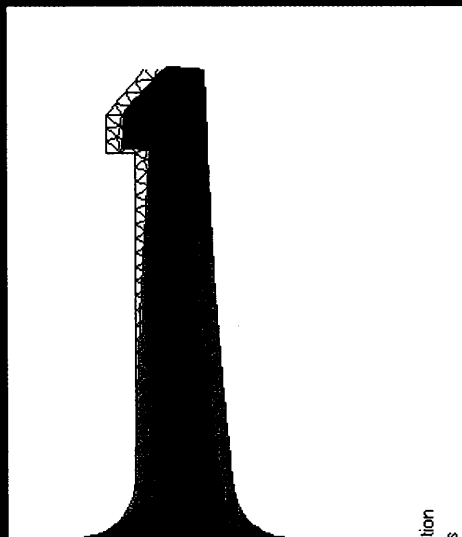
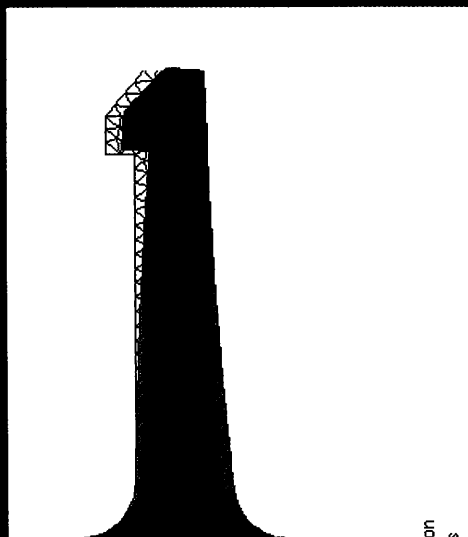
# Flexibility

2 mm deflection

PA

POM

PK



0 %



100 %  $\sigma_{\text{yield}}$

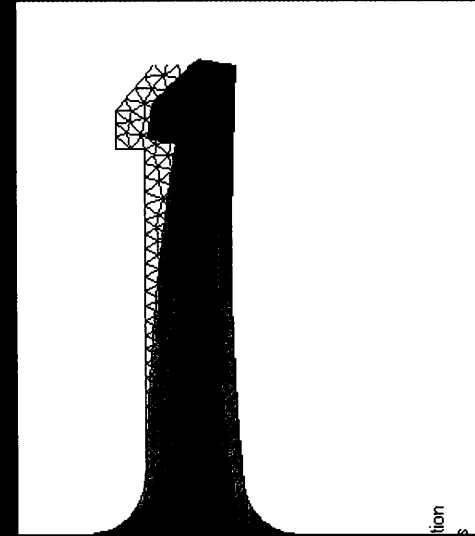
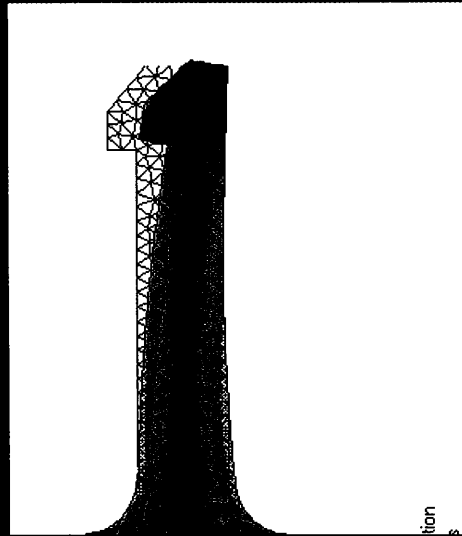
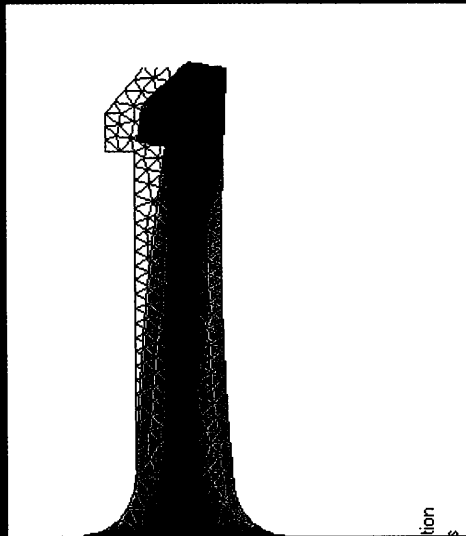
# Flexibility

4 mm deflection

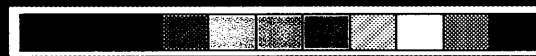
PA

POM

PK



0 %



100 %  $\sigma_{\text{yield}}$

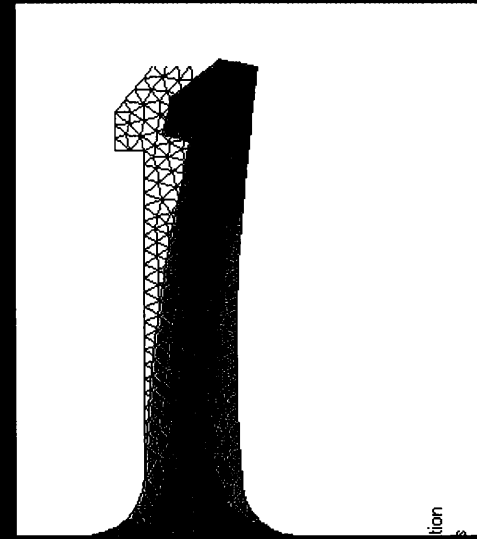
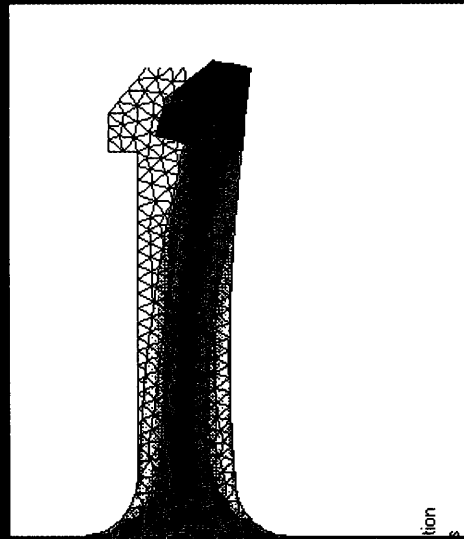
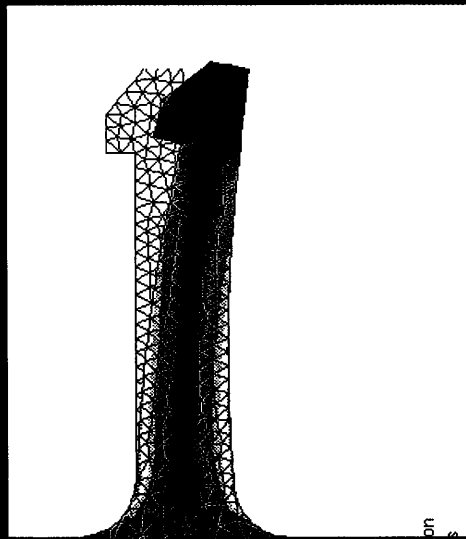
# Flexibility

6 mm deflection

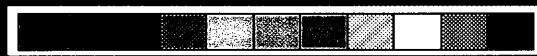
PA

POM

PK



0 %



100 %  $\sigma_{\text{yield}}$

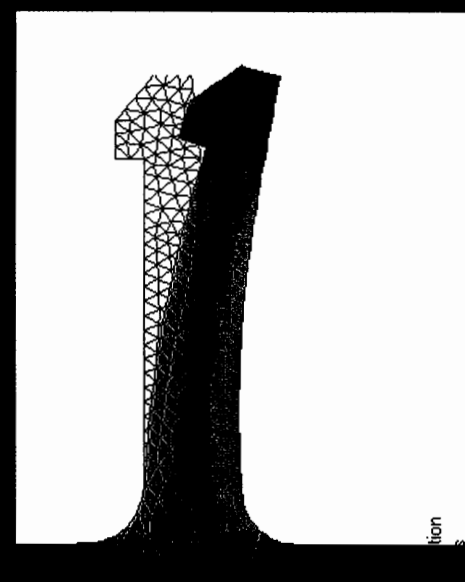
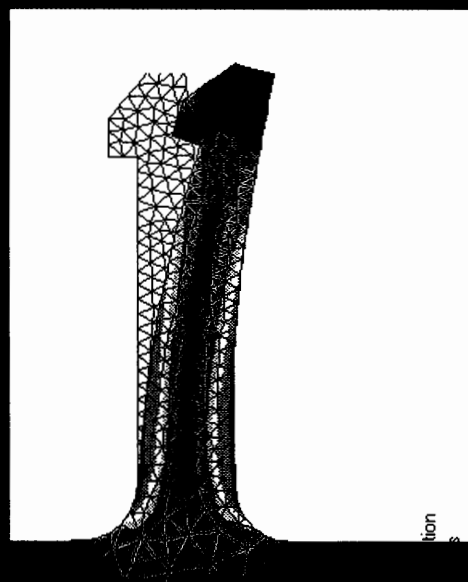
# Flexibility

8 mm deflection

PA

POM

PK



0 %



100 %  $\sigma_{\text{yield}}$

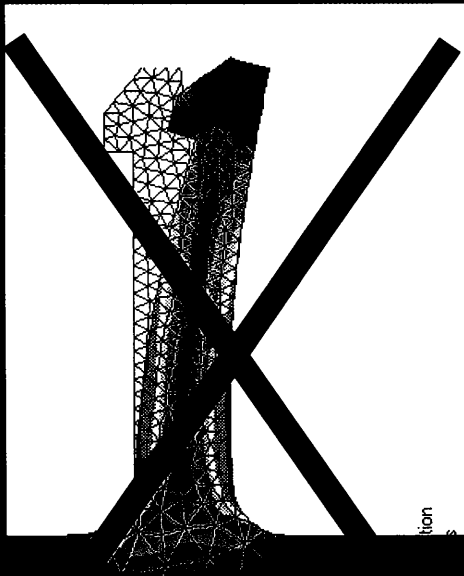


# Flexibility

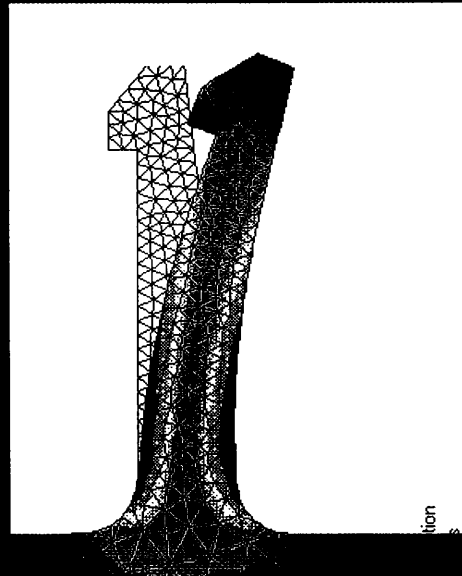
10 mm deflection

PA

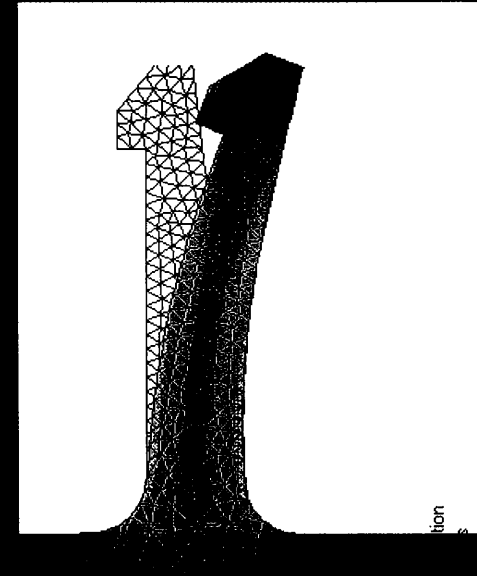
6 mm



POM



PK



0 %



100 %  $\sigma_{\text{yield}}$

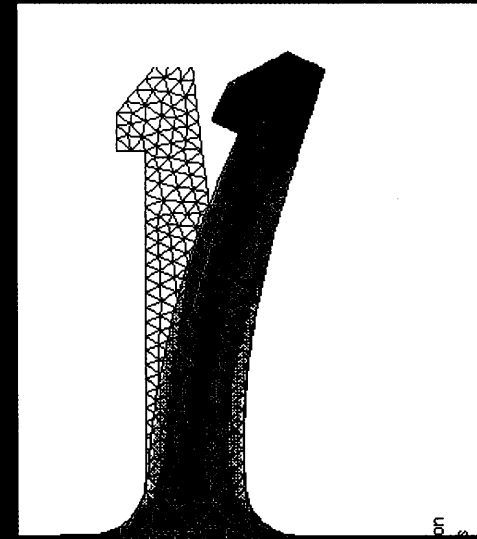
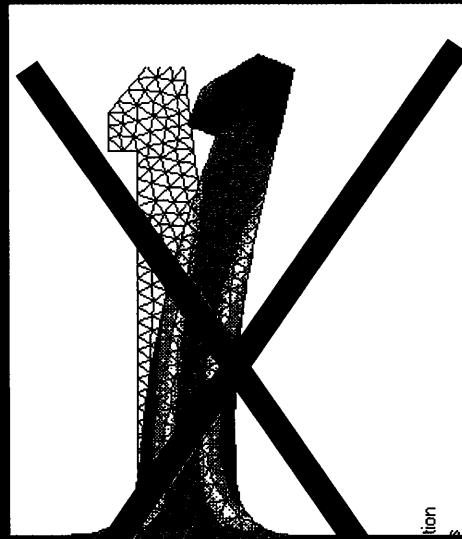
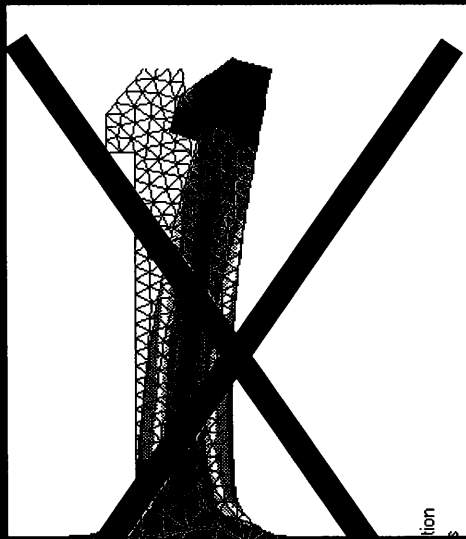
# Flexibility

12 mm deflection

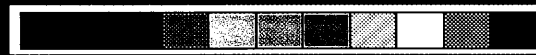
PA

POM

PK



0 %



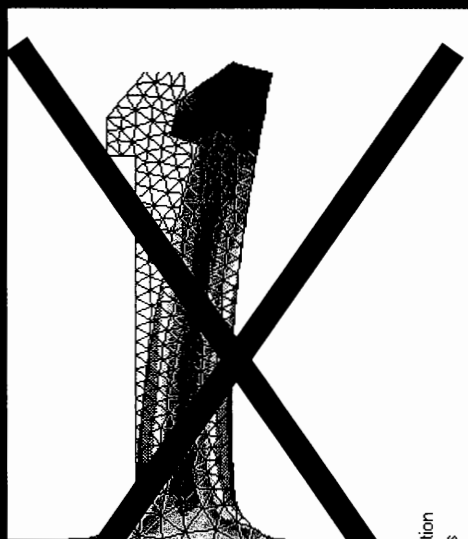
100 %  $\sigma_{\text{yield}}$

# Flexibility

14 mm deflection

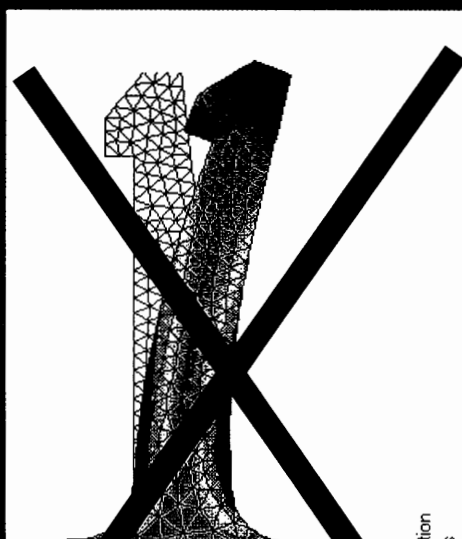
PA

6 mm

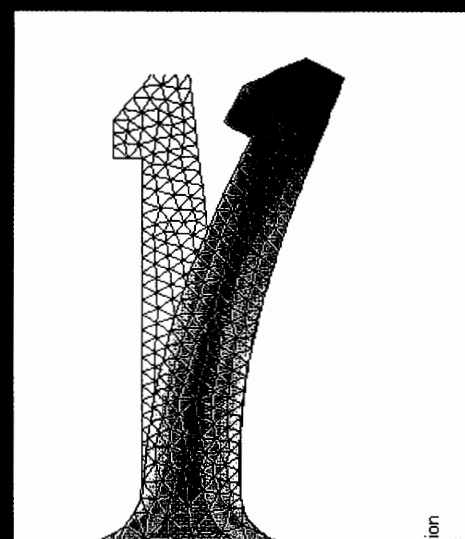


POM

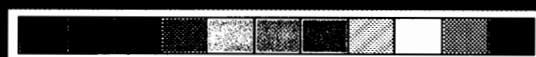
8 mm



PK



0 %



100 %  $\sigma_{\text{yield}}$

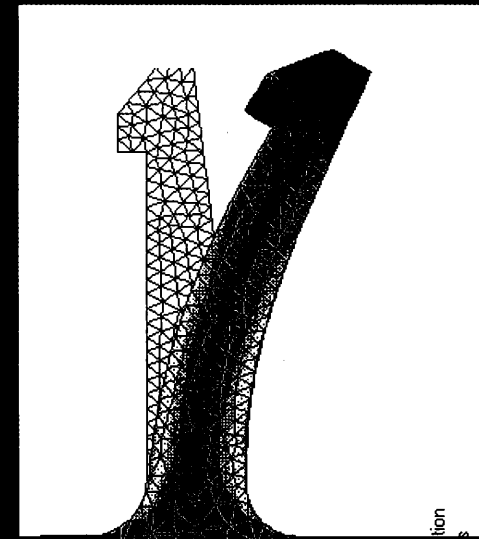
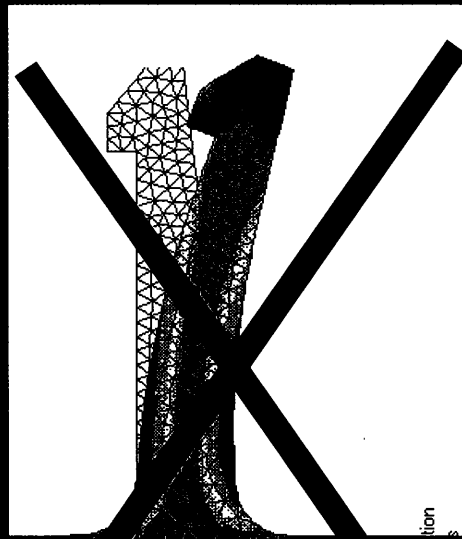
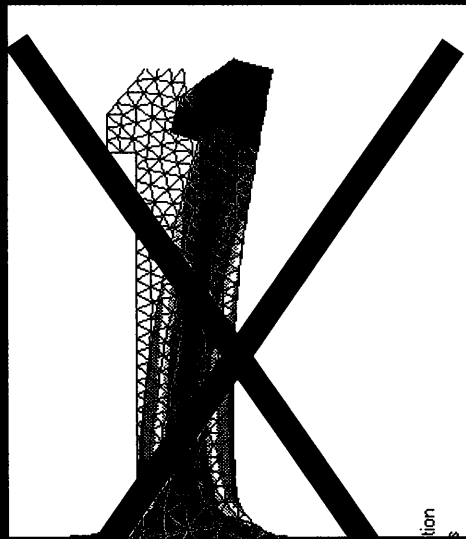
# Flexibility

16 mm deflection

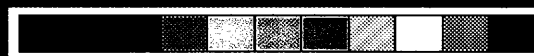
PA

POM

PK



0 %



100 %  $\sigma_{\text{yield}}$

# Flexibility

18 mm deflection

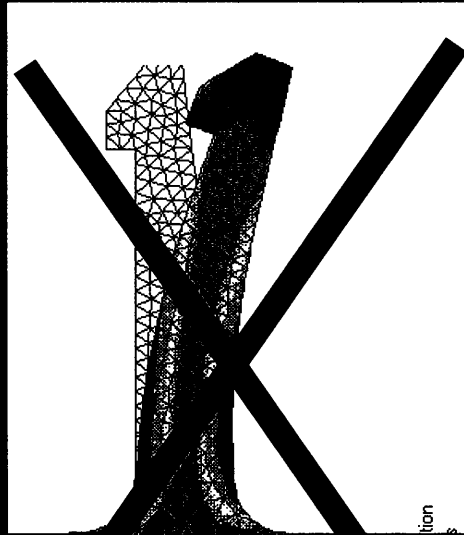
PA

6 mm

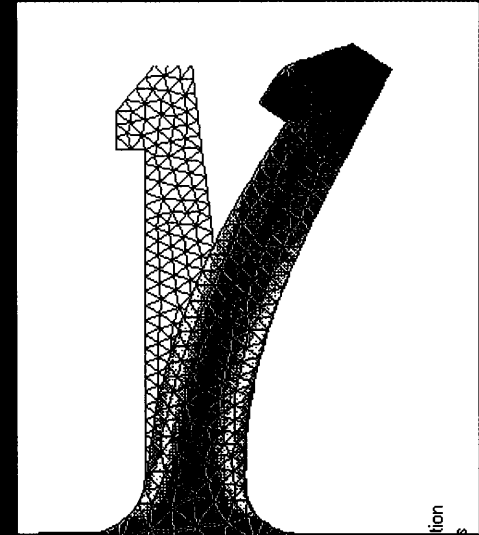


POM

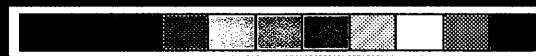
3 mm



PK



0 %

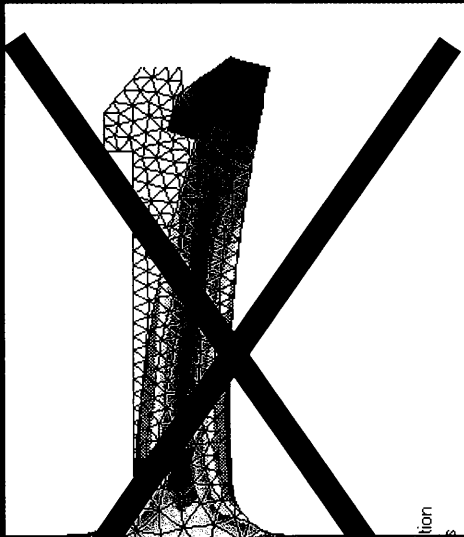


100 %  $\sigma_{\text{yield}}$

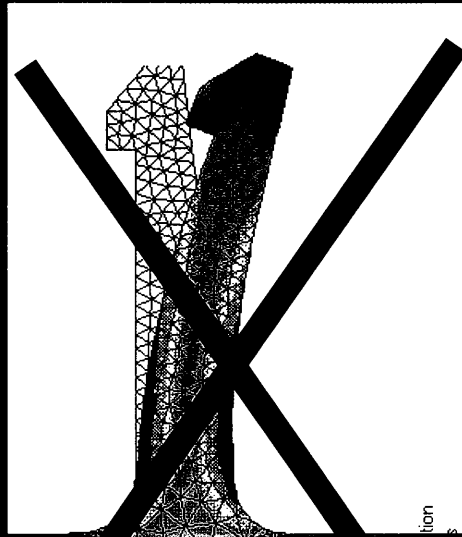
# Flexibility

20 mm deflection

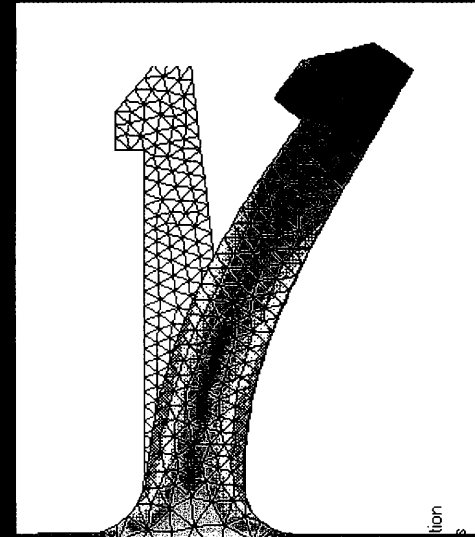
PA



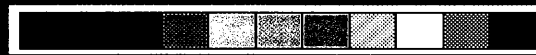
POM



PK



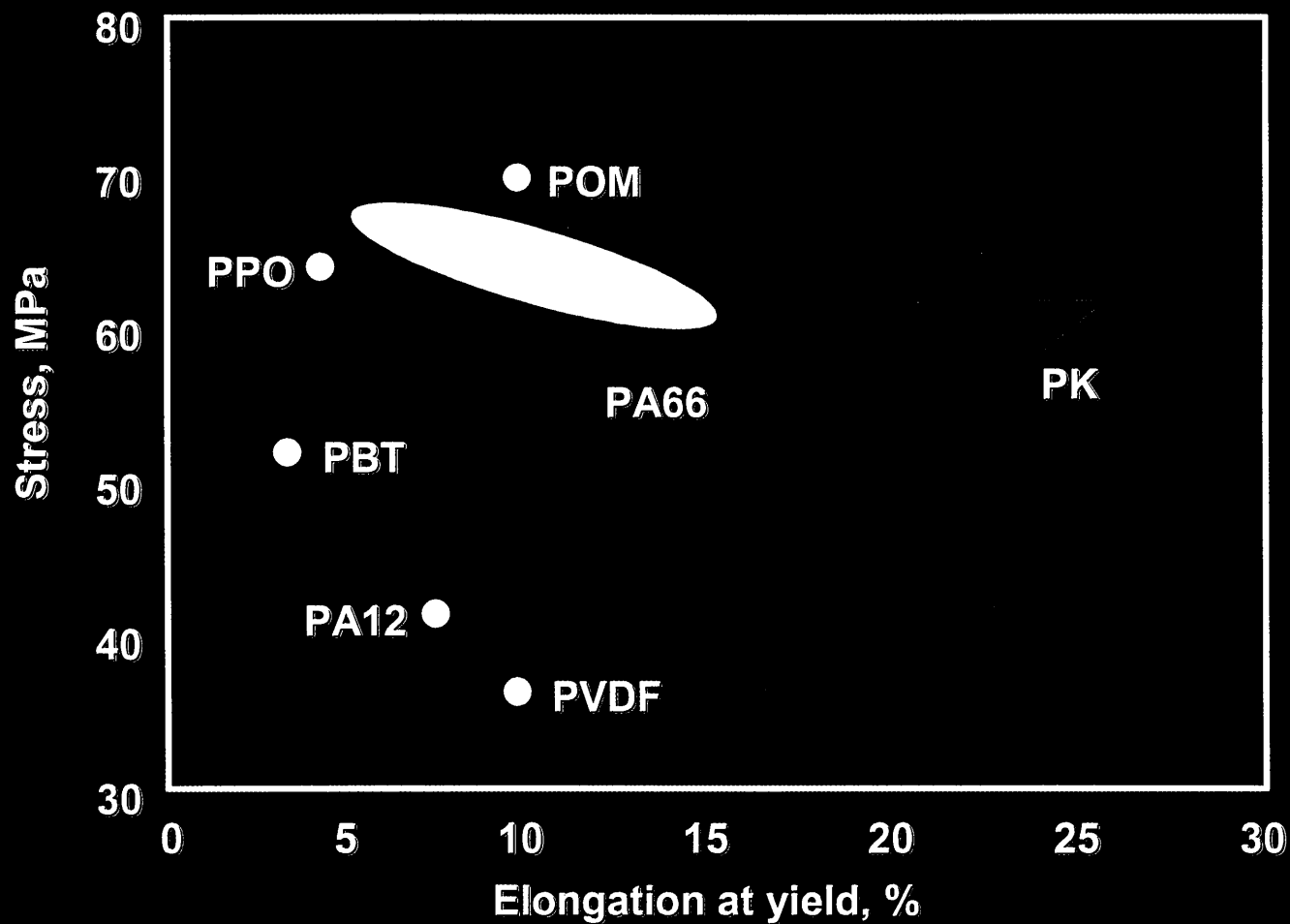
0 %



100 %  $\sigma_{\text{yield}}$

# Flexibility

Tensile yield properties of CARILON Polymers and other ETPs

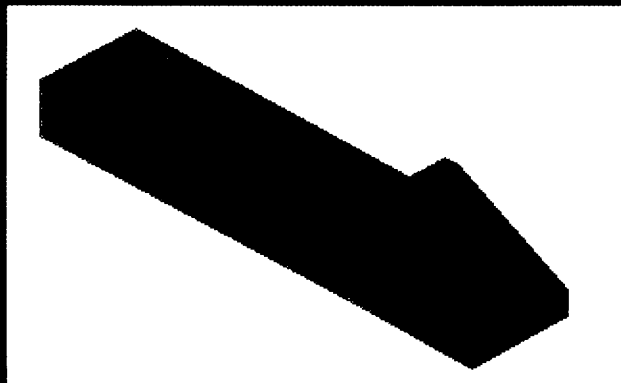


# A designers view

Insertion Force

Water in-sensitivity

Repeatability



Retention force

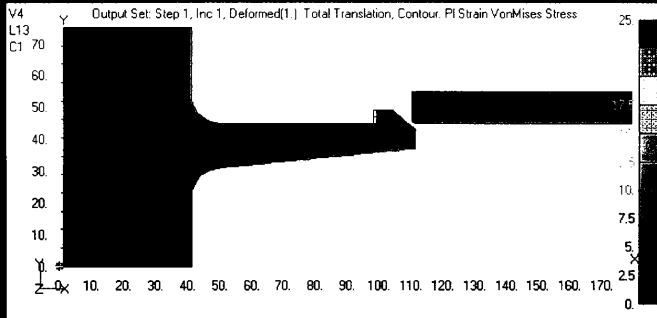
Chemical resistance

Flexibility

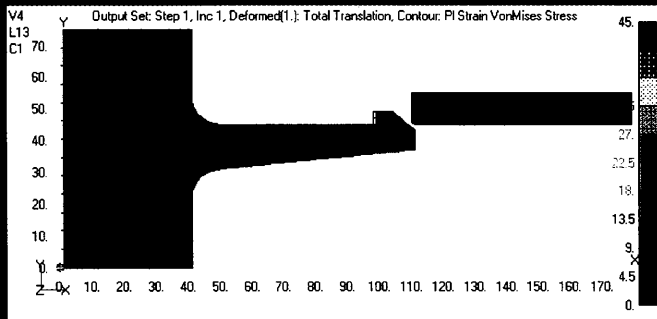


# Insertion force

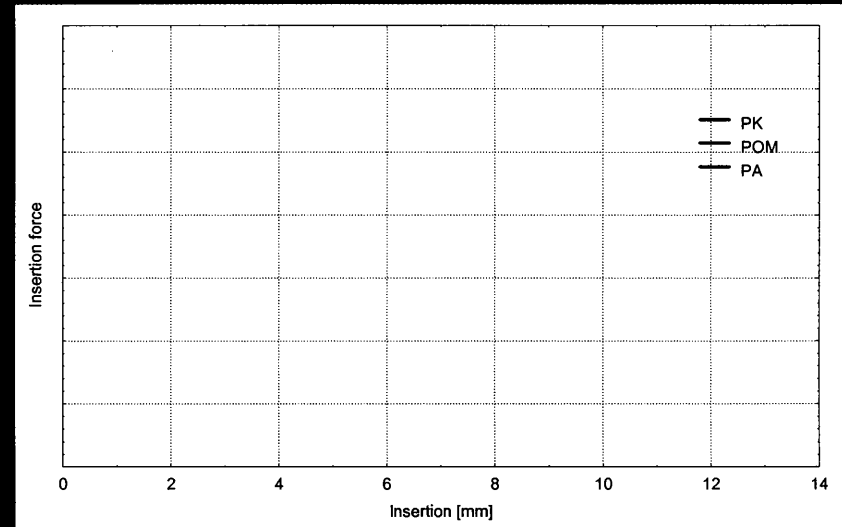
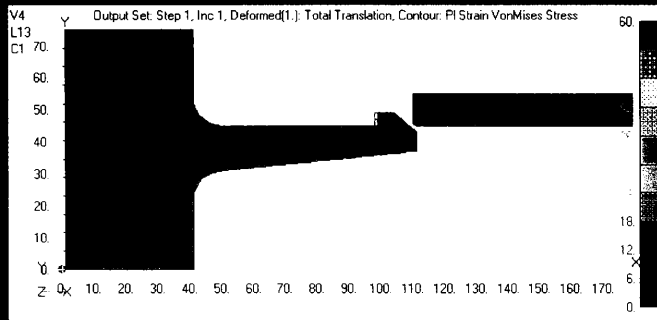
PK



POM

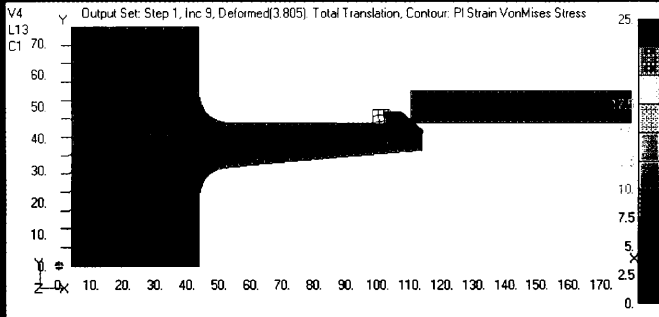


PA

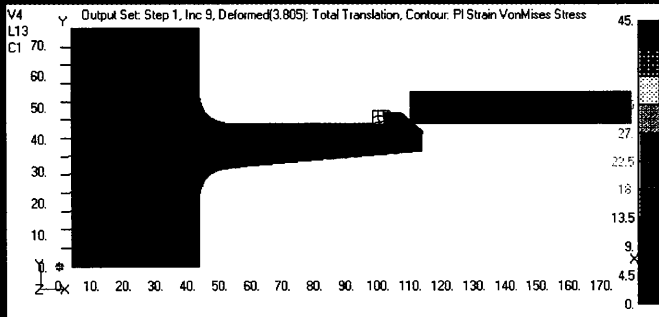


# Insertion force

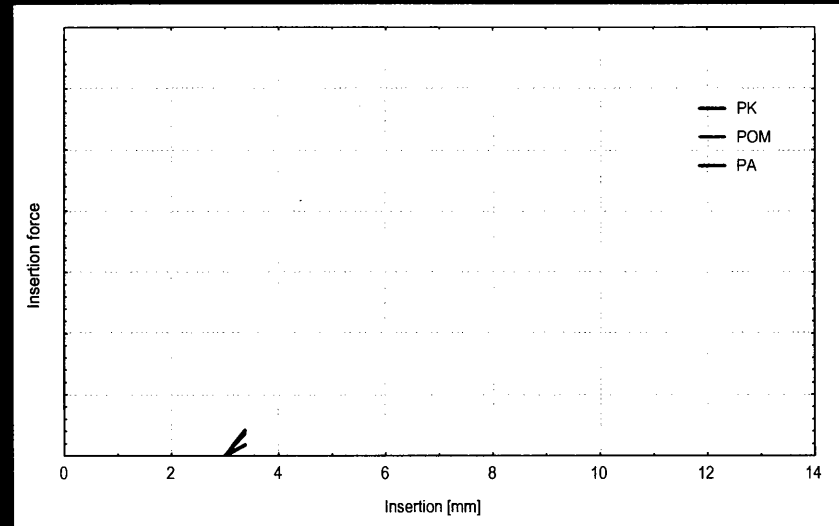
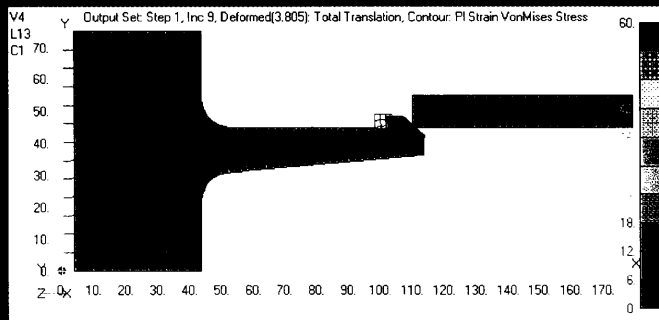
PK



POM

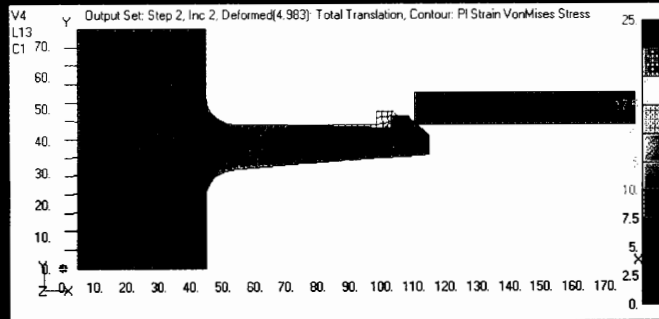


PA

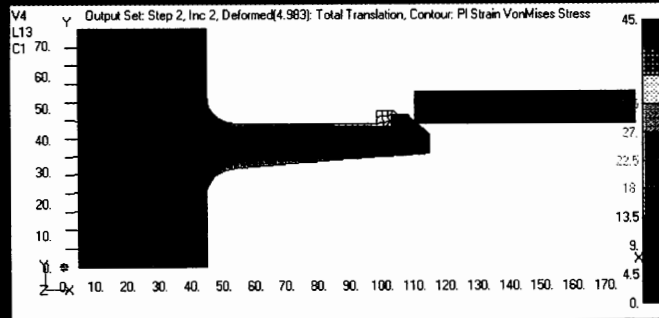


# Insertion force

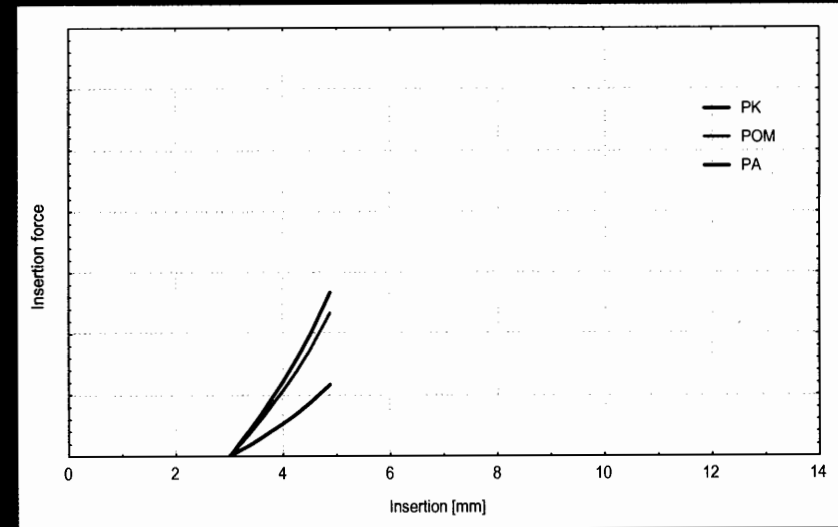
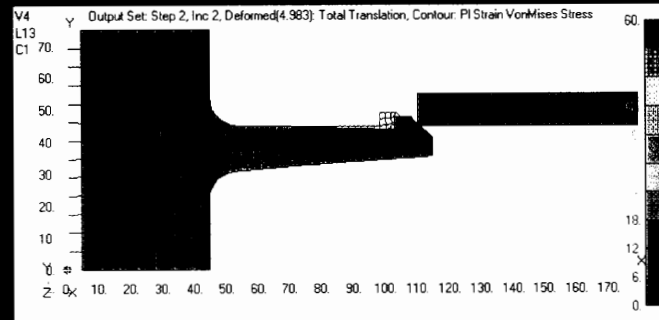
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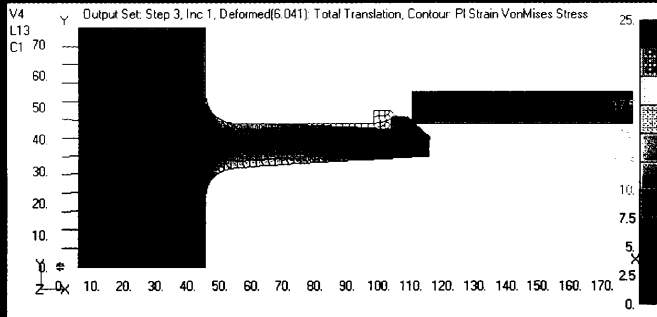


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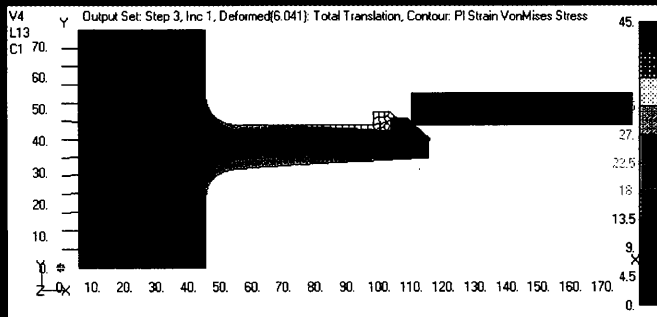


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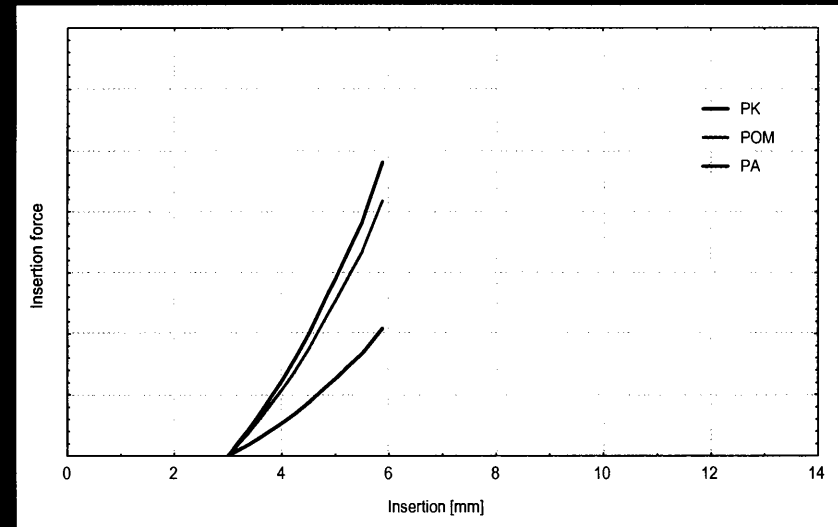
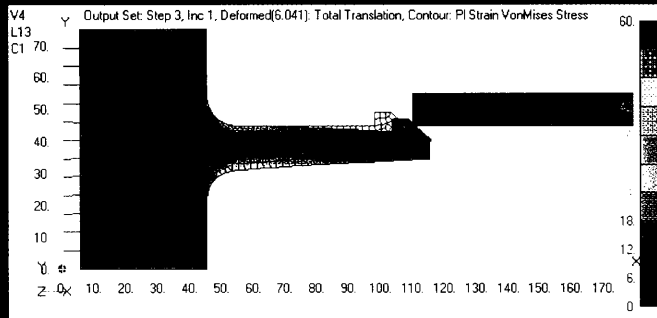
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POM

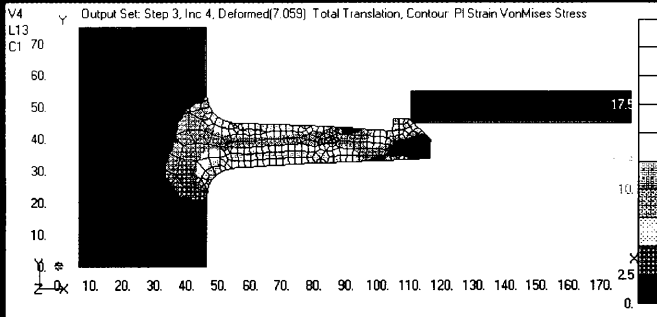


PA

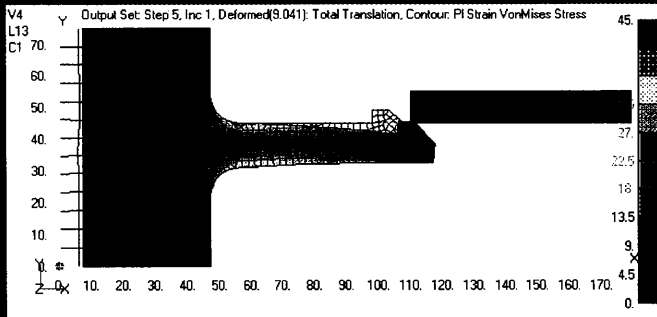


# Insertion force

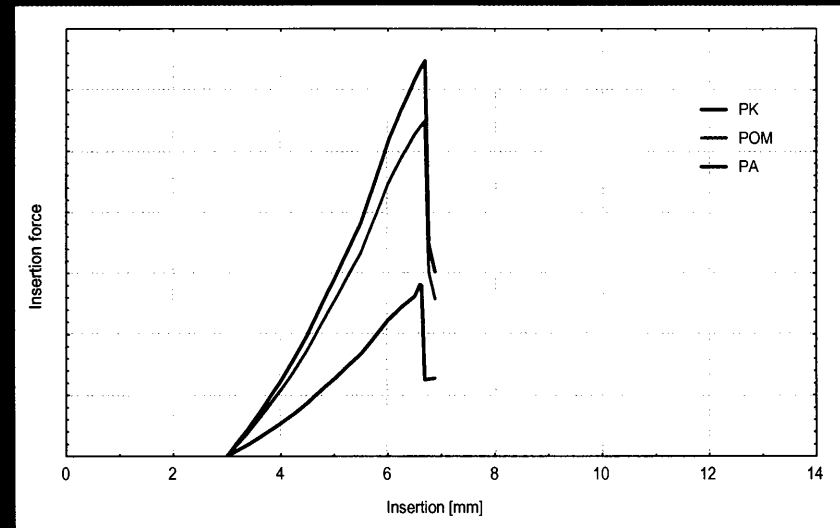
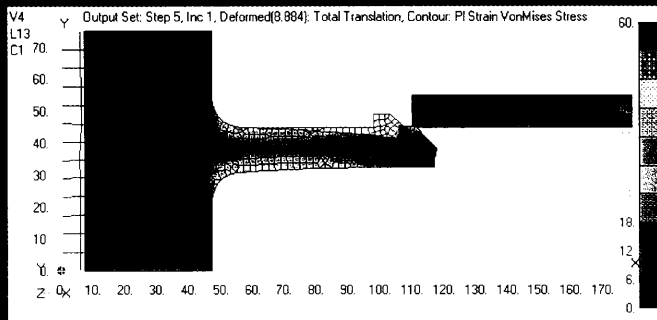
PK



POM

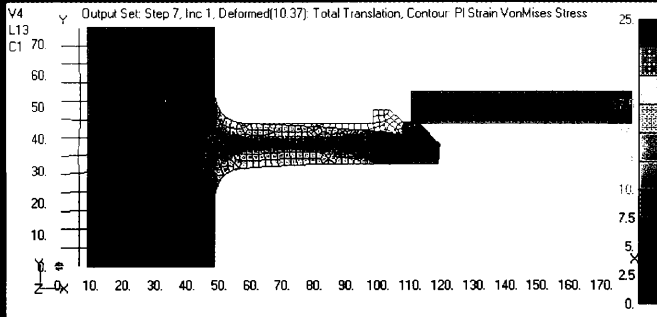


PA

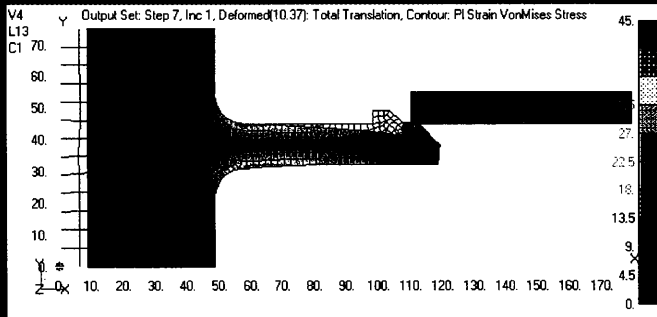


# Insertion force

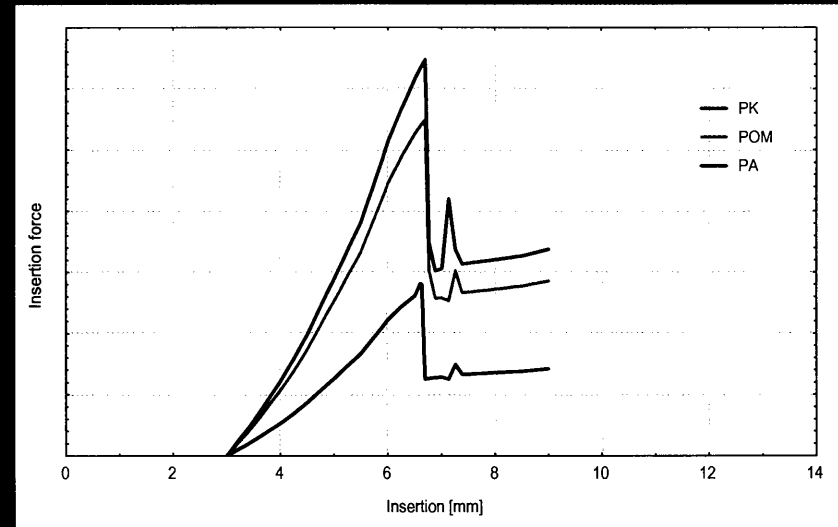
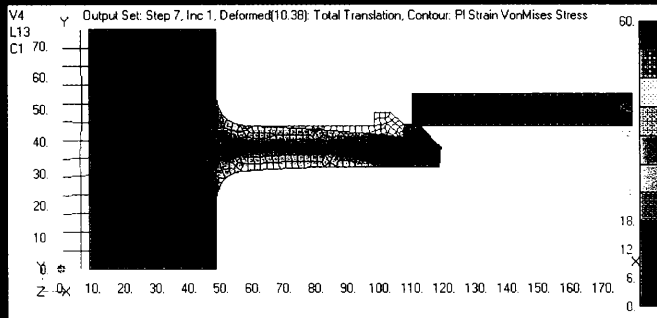
PK



POM

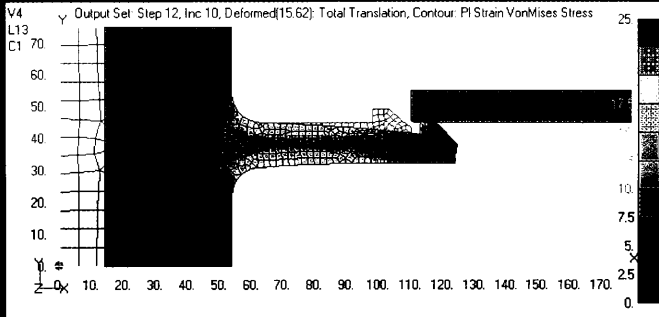


PA

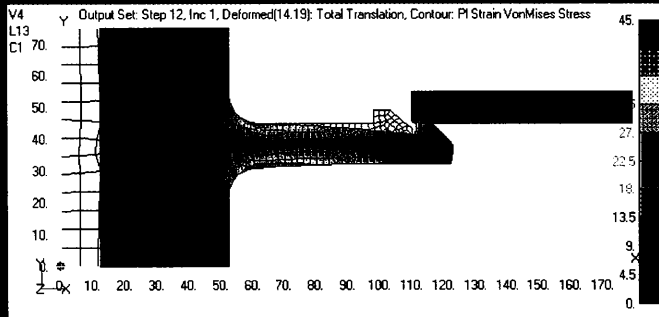


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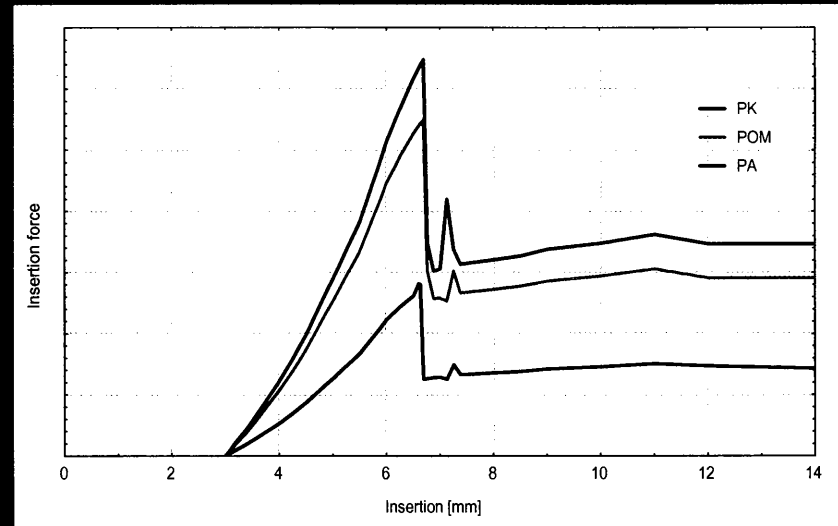
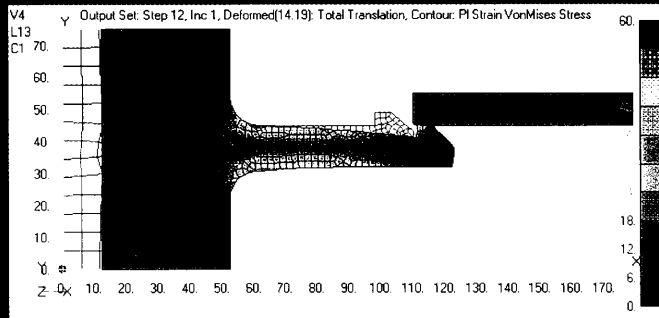
PK



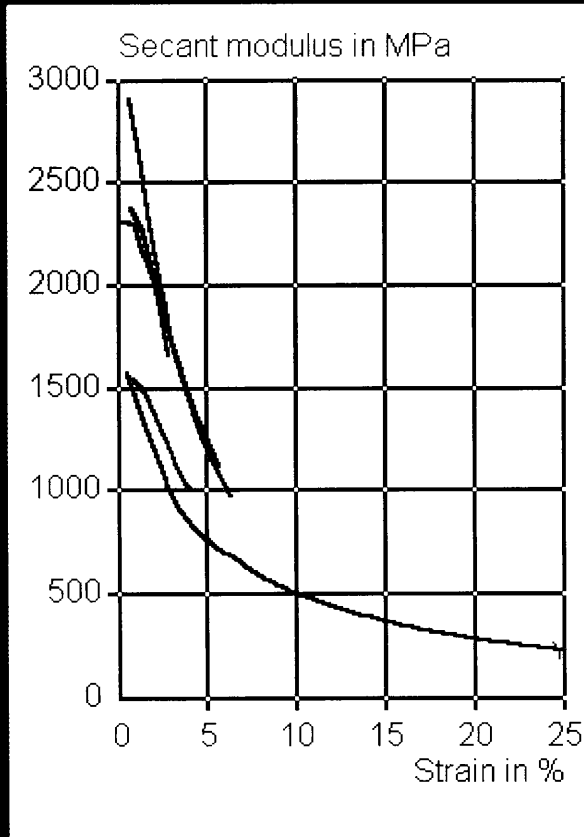
POM



PA



# Insertion force



- 23 °C Carilon D26HM100, SHELL CHEMICALS
- 23 °C CYCOLAC AM, GE Plastics Europe
- 23 °C HOSTAFORM C 13021, HOECHST AG
- 23 °C LEXAN 101R, GE Plastics Europe
- 23 °C Ultramid A3K ~, BASF Corporation

Low modulus



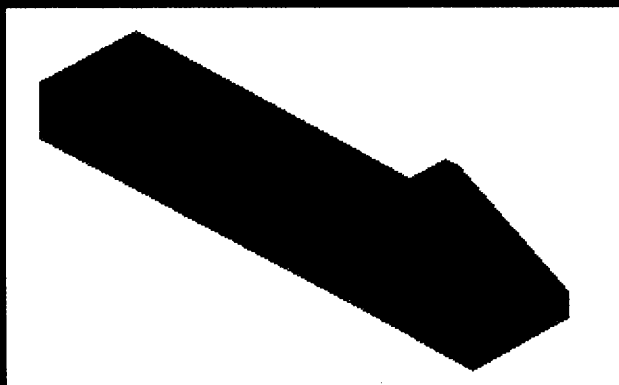
Low insertion force



# A designers view

Water in-sensitivity

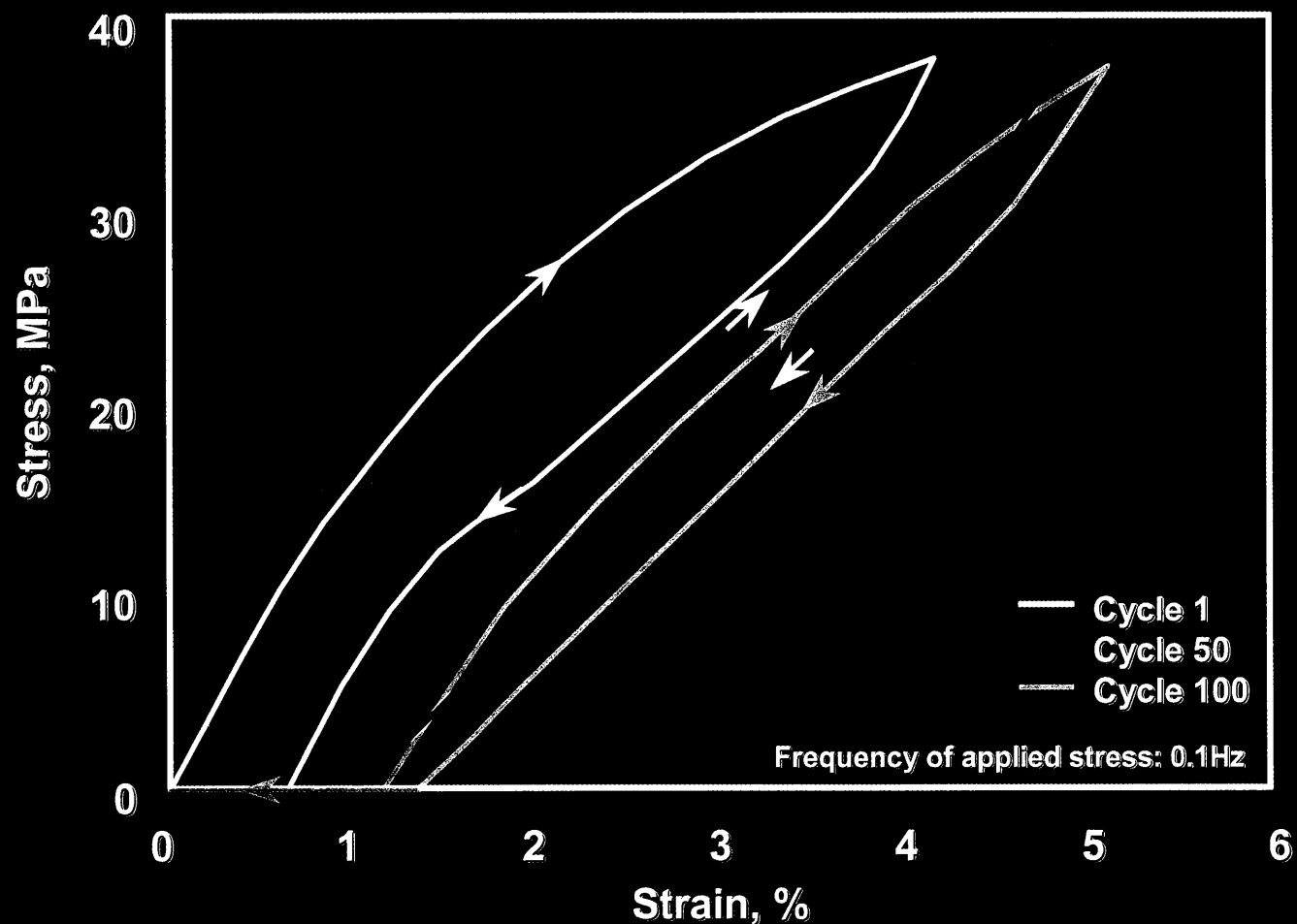
Repeatability



Retention force

Chemical resistance

# Repeatability



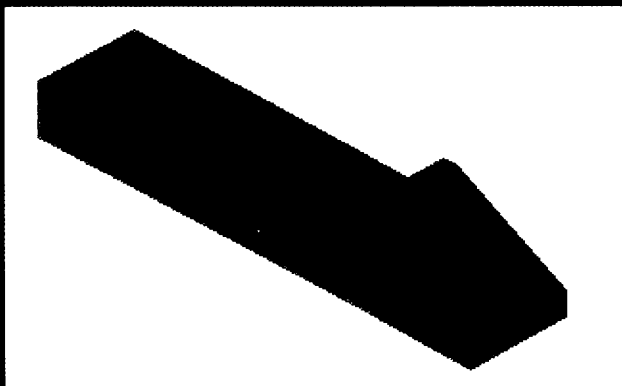
Recovery of CARILON Polymers from high cyclic tensile stress loadings (60% of yield stress) at 23°C, 50% RH

# A designers view

Inertion force

**Water in-sensitivity**

Repeatability



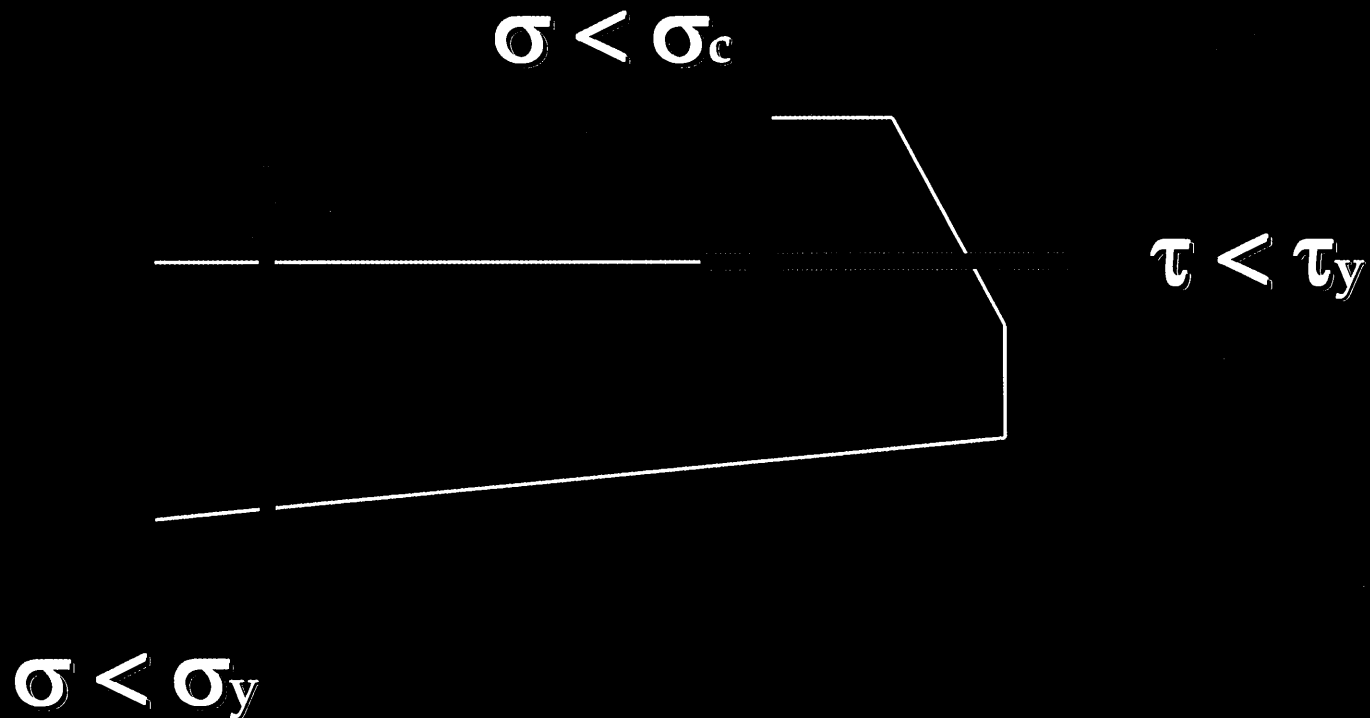
**Retention force**

**Chemical resistance**

Flexibility

# Retention Force

## Possible failure modes



# Retention Force

Low Insertion  
Force

# Retention Force

Cross section of  
the beam can  
be increased

Low Insertion  
Force

Tip height can  
be increased

# Retention Force

Low Insertion  
Force

Cross section of  
the beam can  
be increased

Decreased  
stress  
at pull-off

Tip height can  
be increased

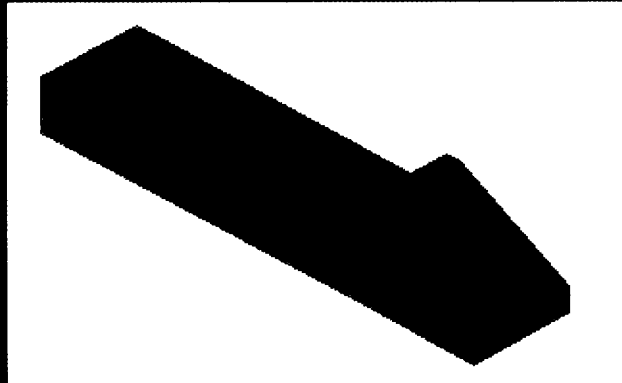
Decreased  
compressive stress  
concentration

# A designers view

Inertion force

**Water in-sensitivity**

Repeatability



Retention force

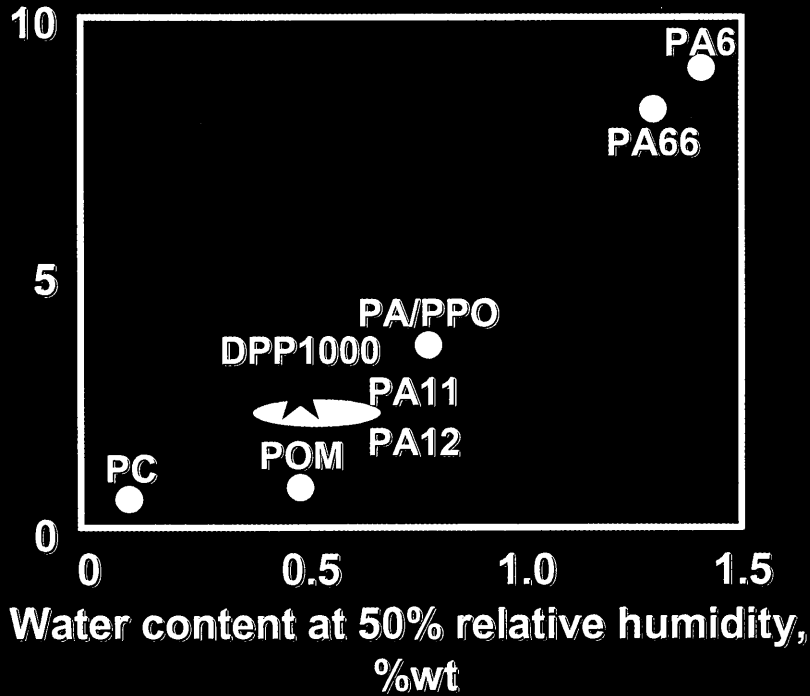
**Chemical resistance**

Flexibility

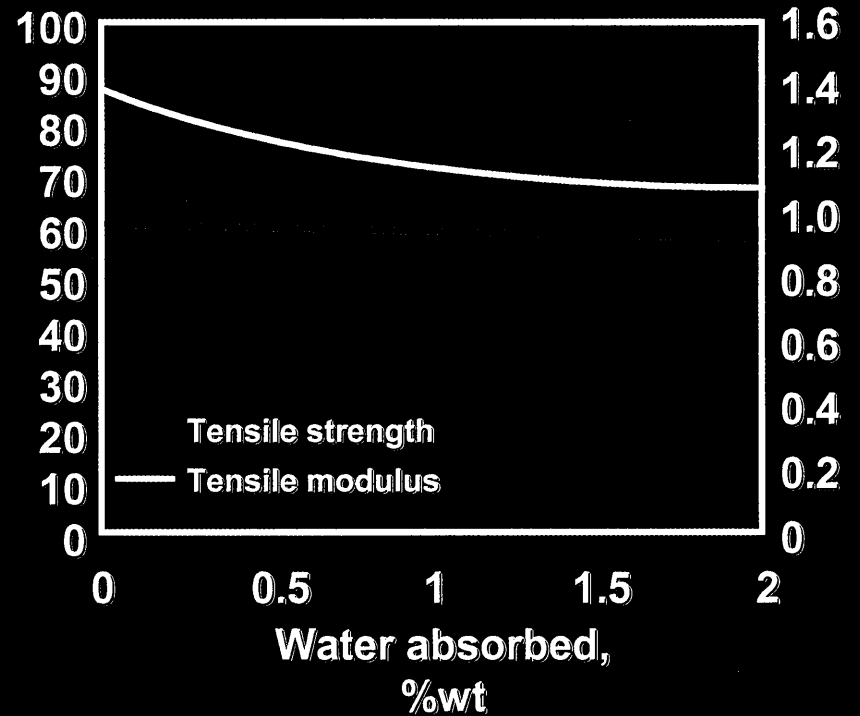


# Moisture Sensitivity

Water content at saturation, wt%



Tensile strength (MPa)      Modulus (GPa)

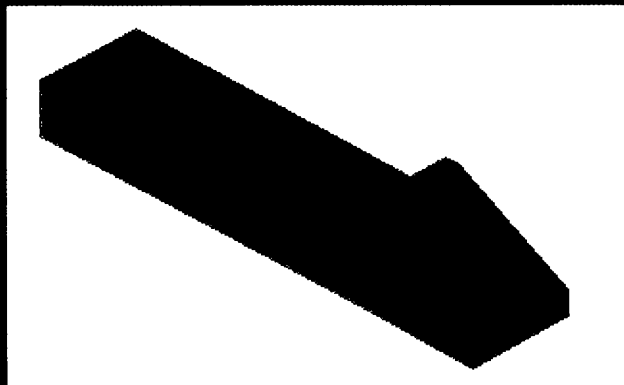


# A designers view

Insertion force

Water insensitivity

Repeatability



Retention force

**Chemical resistance**

Flexibility

# Chemical Resistance

	Semi-crystalline							Amorphous		
	PK	PA66	PA12	POM	PBT	PPS	PVDF	PPO	PSU	PC
<b>Hydrocarbons</b>										
aliphatic	+	+	+	+	+	+	+			
aromatic	+	+	+	+	+	+	+			
halogenated	+	+		+		+	+			
<b>Ketones</b>	+	+	+	+	+	+				
<b>Esters/ethers</b>	+	+	+	+	+	+	+			
<b>Aldehydes</b>	+			+	+	+	+			
<b>Aqueous</b>										
water	+		+	+		+	+	+	+	+
weak acids	+					+	+	+	+	+
weak bases	+			+		+		+		+
strong acids							+	+		+
strong bases				+						+
salt solutions	+				+		+	+	+	+

+ **Resistant**      **Not Resistant**

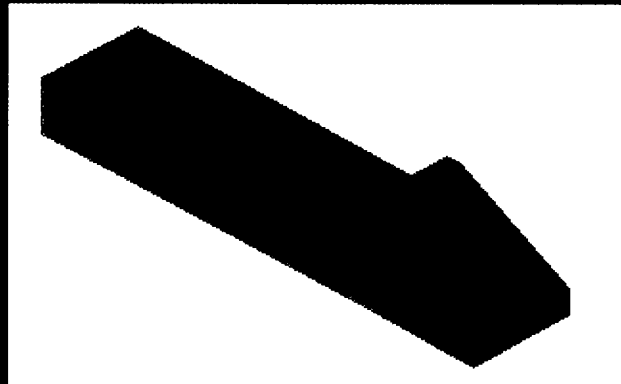
Note: Relative ranking including temperature effects

# A designers view

Insertion force

Water insensitivity

Repeatability



Retention force

Chemical resistance

Flexibility

# Conclusion

