

## *DMTA TEST (Dynamic Mechanical Thermal Analysis) Polyurethane U203-R95*

### **DMTA test Seal Maker PU U203-R95 red vs. competitor H-PU**

Tests have been performed by Akron Polymer Laboratories (APL), Akron, Ohio, USA in July 1999, undersigned by David D. Russel, President Akron Polymer Laboratory.

#### **Results**

As reported in APL report AME-0301 dated 15/07/1999 shows Seal Makers polyurethane U203-R95 superior in several important areas of performance:

1. DMTA (Dynamic Mechanical Thermal Analysis) shows a substantially lower glass transition temperature for polyurethane U203 and a significantly higher softening temperature resulting in better high and low temperature properties.
2. DMTA shows competitor polyurethane becoming glassy just below room temperature as seen by a long steady rise in  $\tan\delta$  as the sample is cooled below room temperature. This means that competitor polyurethane begins to lose resilience and elasticity as soon as the temperature drops below room temperature. By  $-5.7^{\circ}\text{C}$  ( $22^{\circ}\text{F}$ ), competitor polyurethanes glass transition temperature, competitor polyurethane lost all his resilience. Seal Makers polyurethane U203 continues to be resilient through  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ).
3. Consistent with DMTA results at high temperature, Seal Makers polyurethane U203 exhibits better compression set resistance at  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ) than competitor polyurethane.
4. Overall Seal Makers polyurethane has high mechanical strength, excellent properties over a broad range of temperatures and excellent oil resistance.
5. Hydrolytic stability (deterioration in hot water) of Seal Makers polyurethane U203 exceeds competitor polyurethanes far less change in tensile strength and hardness.

## Samples received

Plastic rods identified as:

1. 3 pcs. 1 ½" x 6" red plastic rods with dark red top (Seal Maker PU U203-R95)
2. 3 pcs. 2 ½" x 6" red plastic rod with black top (competitors polyurethane)

## Tests performed

1. Tensile properties at STH per ASTM D-1708 using an Instron Model 1123 tester operating at 5 ipm crosshead speed.
2. Tear strength measurement at STH per ASTM D-624 on Die C specimens using an Instron Model 1123 tester operating at 20 ipm crosshead speed.
3. % compression set measured per ASTM D-395 method B at 70°C (158°F) for 22 hours.
4. % compression set measured per ASTM D-395 method B at 100°C (212°F) for 22 hours.
5. Shore D hardness measurement at STH per ASTM D-2240 using a Shore Instruments Model XD durometer.
6. DMTA (Dynamic Mechanical Thermal Analysis) from -80 to 150°C (-122 to 302°F) on a Polymer Laboratories Mark II DMTA (equipped with Rheometric Scientific Plus V Software, Version 5.42) using single cantilever mode, 1 Hz frequency and 4°C/minute ramp rate.
7. Hydrolytic stability – time to failure at 70°C (158°F) / 95% relative humidity (RH).
8. DIN abrasion resistance measurement at STH per ASTM D-5963 using a standard 60 grit abrasive, standard 1kg (2.25lb) weight and standard 40 meter (131 feet) path length.
9. Sample preparation done by saw cutting and cryogenic grinding.

Table Project #AME-0301

	<b>Seal Maker U203-R95</b>	<b>Competitor H-PU</b>
<b>Physical parameters</b>		
Tensile Strength [PSI]	7185	7936
% UE	390	400
Tear Strength [pli]	451	769
Shore D	47	50
% Comp. Set 22h/70°C	33.5	29.1
% Comp. Set 22h/100°C	40	44
DIN Abrasion Resistance [mg/40m]	86.7	66.6
DMTA		
Tg [°C]	-19.3	-5.4
Tan δ @ 23°C	0.07	0.15
Tan δ @ 100°C	0.03	0.07
<b>Hydrolytic Stability 95%RH/70°C</b>		
Change in Tensile St. [%] at 100 days	-17.6	-26.2
Change in UE [%] at 100 days	2.6	2.5
Change in Shore D [pts] at 100 days	1	-6

### Remark

Due to the similarity of other Seal Maker U203 polyurethane compounds (only colour different and/or additional fillers added), we may anticipate that above test results and data are valid for all Seal Maker U203 polyurethane compounds in 95 Shore A.