

Technical Information for Performance Solutions

Special points of interest:

- Molding
- Transfer and
Compression Molding
- Injection Molding
- Summary

MOLDING OF MILLATHANE® MILLABLE URETHANE RUBBER

Millathane millable polyurethane rubbers are processed on conventional rubber processing equipment such as mills, internal mixers and calenders. Like other synthetic rubbers, Millathane compounds can be compression, transfer and injection molded. Millable polyurethane rubbers can be extruded to make preforms for compression molding or strips for injection molding or for use in extrusion roll building. Alternatively, millable polyurethanes rollers can be produced with an extruder using a cross-head die. A discussion of injection, transfer and compression molding will be presented in this issue of TIPS.

Molding

Millathane compounds can be molded using compression, transfer and injection molding techniques. Problems which may be encountered are similar to those experienced with other synthetic rubbers and can usually be solved through mechanical or compounding modifications. The linear shrinkage of vulcanizates of millable urethane compounds varies somewhat with the type of loading, ranging from approximately 1.5% to 2.5%.

Optimum press cures are obtained with sulfur systems at temperatures from 285°F (140°C) to 330°F (165°C), with curing times varying from approximately seven to 60 minutes. With peroxide curing systems, temperatures from 300°F (149°C) to 360°F (182°C) are suggested, depending on the peroxide used, with cycles ranging from two to 20 minutes.

Excellent mold release is provided by using Crystal® 1053 water-based mold release or silicone mold release lubricants, but indiscriminate use can cause poor flow and knitting problems.

Transfer and Compression Molding

The choice of time and temperature for curing molded goods is of utmost importance. The best properties of millable urethane compounds are obtained by curing at longer times at low temperatures particularly with a sulfur-cured system. Millthane compounds are also cured with peroxide curing agents. Cure cycles may be reduced by using higher temperatures, with some sacrifice to the physical properties. Reversion can occur when temperatures are too high or if compounds are cured too long.

As with other synthetic rubber compounds, the same state of cure may be obtained at different temperatures by varying the time of cure. Cure time is reduced by approximately half for each 18°F (10°C) increase in temperature.

Injection Molding

Millthane millable urethane compounds can be injection molded to produce highly abrasion resistant parts. The Mooney viscosity of the millable urethane compounds should be in the range of 35 to 45 ML(1+4) at 100°C for good flow. Product bulletins should be consulted for incorporation of process aids and balancing filler and plasticizer levels. Cure times can be shortened by adjusting the temperature or by suitable choice of peroxide or sulfur curing agents. As with other synthetic rubbers, time, temperature and pressure parameters must be determined before going into production.

The small rollers seen in the picture on page 3 were molded using the conditions shown in the table below. These small molded rollers were made from the Millthane HT compound shown, and are used in ATM machines worldwide. In this application excellent abrasion resistance and high coefficient of friction are required.

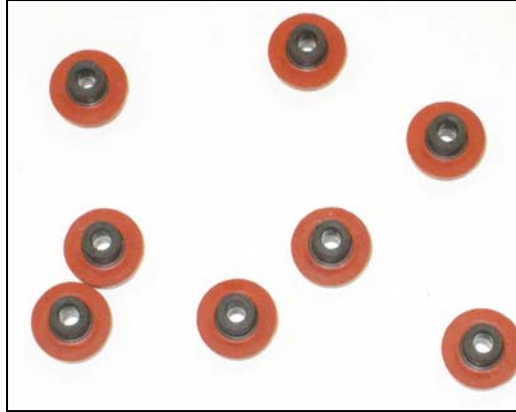
INJECTION MOLDING CONDITIONS

Screw & Barrel	70°C - 80°C (158°F - 176°F)
Accumulator	70°C - 80°C (158°F - 176°F)
Mold Temperature	170°C (338°F)
Cure Time	6 minutes
Injection Pressure	50 Bar (725 psi)
Injection Speed	50 mm/sec (1.96 in/sec)



MILLATHANE® FACTOID:
Although the resistance of polyester urethane to water at elevated temperatures is deficient to polyether grades, this property can be improved significantly by the addition of carbodiimides. Contact TSE for specific recommendations.

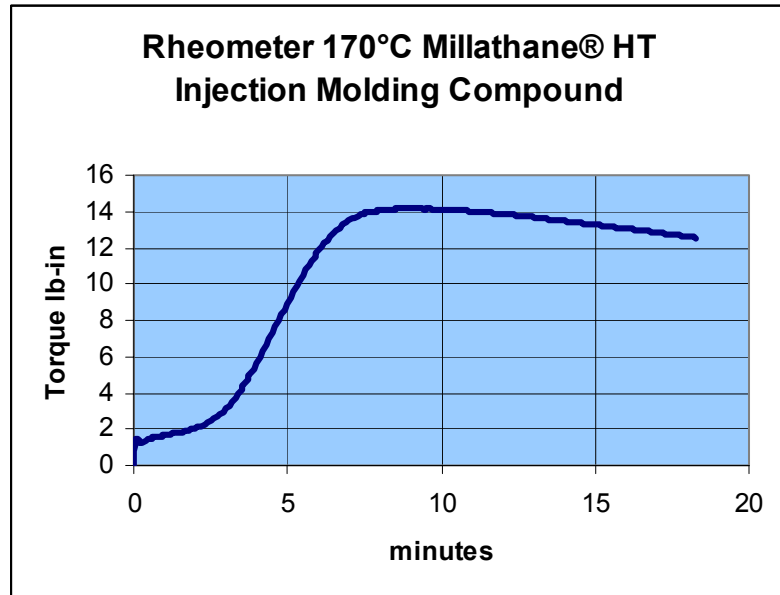
TIPS



MILLATHANE® HT INJECTION MOLDING COMPOUND

Millathane HT	100.0	Physical Property, Cure 7' / 170°C (338°F)	
Zinc Stearate	0.5	Durometer, Shore A	70
Carbowax 3350	2.0	100% Modulus, psi (MPa)	185 (1.3)
Hi-Sil 233	25.0	200% Modulus, psi (MPa)	278 (1.9)
TP-95	5.0	300% Modulus, psi (MPa)	432 (3.0)
Red Iron Oxide	1.0	Tensile Strength, psi (MPa)	3360 (23.2)
MBTS	4.0	Elongation, %	675
MBT	2.0	Tear Die C, lb/in (kN/m)	176 (30.8)
Thanecure® ZM	2.0	DIN Abrasion, mm ³ loss	92
Sulfur	2.0		

MILLATHANE® FACTOID:
 Did you know that transparent, high hardness (90 Shore A) compounds with excellent physical properties (3000 psi/21 MPa tensile and 300% elongation) can be made with Millathane 97?



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SUMMARY

Rubber molders can take advantage of Millathane[®] polyurethane rubber to produce highly abrasion and oil resistant parts by using compression and transfer molding. Additionally, polyurethane parts can be injection molded to improve productivity compared to cast urethane systems.

Contact your Millathane technical service representative for additional information.