

VitriCycle™-75

Recycled polyether-PU elastomer masterbatch — for dilution with virgin TPU

This product is a masterbatch, not a finished molding compound. Dilute with virgin polyether TPU before processing. Maximum recommended recycled content in the finished part: 40 wt%.

VitriCycle-75 is a high-loading masterbatch containing 75 wt% vitrimerized TDI polyether polyurethane foam in a virgin polyether TPU carrier. It is supplied for letdown into virgin polyether TPU, allowing molders to reach a target recycled content in injection-molded parts while keeping the virgin TPU matrix continuous.

PRODUCT IDENTITY

Attribute	Description
Product form	Compounded masterbatch pellets — for dilution with virgin TPU
Composition	75 wt% vitrimerized TDI polyether PU foam / 24.5 wt% virgin polyether TPU / 0.5 wt% thermal stabilizers and anti-oxidants
Recycled phase	Vitrimerized TDI polyether polyurethane foam (crosslinked recycled PU elastomer)
Intended use	Let down with virgin polyether TPU, then injection molded
Recommended letdown	33 – 50 wt% masterbatch in the final compound
Maximum recycled content	40 wt% in the finished part (≈53 wt% masterbatch)
Recommended melt temperature	200 – 220 °C — see melt flow data and note 4
Typical appearance	Amber / tan pellets

PRIMARY PROPERTIES

Property	Test method	Unit	Typical	Target range
Density	ASTM D792 / He pycnometry	g/cm ³	1.115	1.112 – 1.117
Hardness	ASTM D2240	Shore A	75	73 – 77
Glass transition (soft segment)	DSC, 5 °C/min	°C	–54	–53 to –55
Melt flow index	ASTM D1238, 220 °C / 9.9 kg	g/10 min	52.4	51.8 – 53.0
Tensile strength †	ASTM D412	psi	500	480 – 750
Elongation at break †	ASTM D412	%	130	125 – 300
Stress at 100% elongation †	ASTM D412	psi	435	430 – 700

† Provisional — see note 5.

MELT FLOW VS. TEMPERATURE

ASTM D1238, 9.9 kg load, 6 min preheat. Duplicate determinations at each temperature.

Condition	Typical (g/10 min)	Target range (g/10 min)	Notes
200 °C / 9.9 kg	15.7	15.4 – 16.0	Low end of recommended window
210 °C / 9.9 kg	25.3	24.4 – 26.3	Mid window
220 °C / 9.9 kg	52.4	51.8 – 53.0	Upper window — reference condition

SECONDARY PROPERTIES

Property	Test method	Unit	Typical	Target range
Stress at 50% elongation †	ASTM D412	psi	275	270 – 400
Young's modulus (0.5–5 % strain) †	ASTM D412	psi	965	920 – 1010
Apparent flow activation energy	Arrhenius fit, MFI ladder	kJ/mol	117	—

LETDOWN GUIDE

Masterbatch in compound	Resulting recycled content	Recommendation
100 %	75 %	Not recommended
75 %	56 %	Not recommended
60 %	45 %	Marginal
53 %	40 %	Maximum recommended recycled content
50 %	37.5 %	Recommended
40 %	30 %	Recommended
33 %	25 %	Conservative — easiest processing

NOTES & CONDITIONS

- THIS PRODUCT IS A MASTERBATCH, NOT A FINISHED MOLDING COMPOUND.** It is designed to be diluted with virgin polyether TPU before processing. The properties tabulated here are those of the undiluted masterbatch and are provided for formulation purposes; they are not the properties of the finished part.
- Recommended maximum recycled content in the finished compound is 40 wt%, corresponding to approximately 53 wt% masterbatch letdown. Operating below this threshold keeps the virgin TPU matrix continuous, which is where processing behavior and mechanical properties are most favorable.
- Recommended working range is 33–50 wt% masterbatch (25–38 wt% recycled content). Melt flow of the let-down compound is substantially higher than that of the neat masterbatch, and improves faster than simple linear or log-additive mixing would predict.
- Melt temperature is the dominant process variable. Melt flow increases approximately 3.3-fold between 200 °C and 220 °C — roughly a factor of 1.8 for every 10 °C — so a ± 5 °C drift changes flow by approximately 35 %. Melt temperature should be measured directly at the die or nozzle adapter rather than inferred from barrel setpoints. Do not exceed 250 °C, at which thermal decomposition begins. The corresponding apparent flow activation energy of 117 kJ/mol is well above the 40–80 kJ/mol typical of conventional thermoplastic polyurethanes, and is consistent with flow governed by dynamic covalent bond exchange rather than chain disentanglement alone; it is derived from a three-point melt flow ladder at a single shear rate and is therefore an apparent, not a rigorous rheological, value.
- Tensile properties are provisional and are expected to be conservative. Measured values were obtained on specimens processed near 190 °C, where melt viscosity is approximately six times higher than at 220 °C; strength, modulus and elongation all fell together relative to established composition trends, which is characteristic of incomplete fusion or residual voids rather than an intrinsic material limit. The upper end of each range reflects composite-model and trend-based expectation for fully consolidated material. Confirmatory testing with 200–210 °C processing is in progress.
- Dry before processing: 90–100 °C for a minimum of 4 hours to below 0.02 % moisture. TPU is hygroscopic and residual moisture at melt temperature causes chain scission, reducing mechanical properties.
- Polyether TPU is the recommended letdown resin, giving the closest soft-segment match to the recycled phase. Polyester TPU may be used where the application permits, but requires carbodiimide stabilization (1–2 wt%), stricter drying, and is not recommended for wet, humid or outdoor service because of the hydrolytic sensitivity of ester linkages.
- DSC analysis shows a single glass transition at -54 °C, with no melting endotherm and no crystallization exotherm on cooling. This is consistent with an amorphous crosslinked network rather than a semi-crystalline thermoplastic.
- Values are typical data for evaluation and formulation. They are not specification limits and do not constitute a warranty.
- Not evaluated for food-contact, medical, or child-contact applications; additional testing is required for regulated uses.