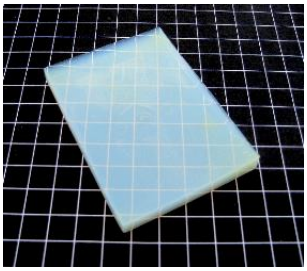
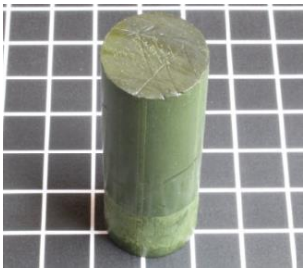
AIRLOY® ULTRAMATERIALS
TECHNICAL DATASHEETS

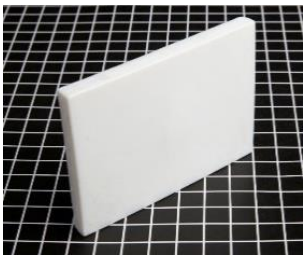
PRODUCT LINES



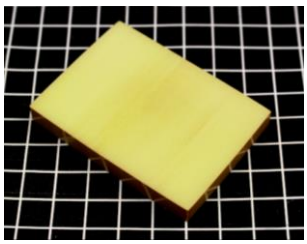
Airloy® X50 Series
Composition: Silica-polymer hybrid
Features: Optical transparency, low thermal conductivity, non-brittle
Availability: Currently available on BuyAerogel.com



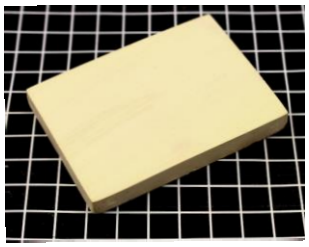
Airloy® X60 Series
Composition: Vanadia-polymer hybrid
Features: Cryogenic ductility, high specific energy absorption, impact damping
Availability: Custom solutions



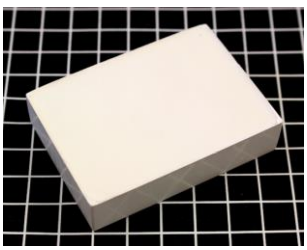
Airloy® X100 Series
Composition: Polyurea
Features: High strength, low cost, low thermal conductivity, high sound damping
Availability: Currently available on BuyAerogel.com



Airloy® X110 Series
Composition: Polyimide
Features: High operating temperature, non-flammability, low thermal conductivity, solvent resistance
Availability: Currently available on BuyAerogel.com



Airloy® X120 Series
Composition: Polyamide
Features: High stiffness, non-flammability, high operating temperature
Availability: Custom Solutions



Airloy® X130 Series
Composition: Polyurethane
Features: Low cost, mid-range operating temperature, rigid-to-flexible
Availability: Currently available on BuyAerogel.com

VALUE PROPOSITION

Airloy Ultramaterials are lightweight plastics replacements that combine numerous disparate extreme materials properties into a single multifunctional material envelope. Airloys are 3-15x lower density than plastics yet possess the durability expected of engineering materials. Airloys offer thermal conductivity better than or comparable to polyurethane foams, EPS, and some aerogel composite blankets without dust in a monolithic form factor. Airloys also provide superior acoustic transmission loss thanks to their combination of nanoporous structure, high modulus, and low density. Where applications call for lightweight structural materials Airloys are a superior replacement for plastics and foams, offering weight savings with multiple ancillary benefits.

PART NUMBER FORMAT

A	B	C	–	D	F

A: Market
- A: Aviation
- C: Construction
- X: General

B: General Composition
- 5: Silica-Polymer Hybrid
- 6: Vanadia-Polymer Hybrid
- 10: Polyurea
- 11: Polyimide
- 12: Polyamide
- 13: Polyurethane

C: Specific Composition

D: Density Class
- L: 0.1 g/cc to 0.15 g/cc
- M: 0.2 g/cc to 0.25 g/cc
- H: 0.4 g/cc to 0.45 g/cc
- XH: 0.55 g/cc to 0.6 g/cc

F: Options

APPLICATIONS

- **Engineering Materials**
- **Aviation Interiors**
- **Consumer Electronics**
- **Automotive Plastics**
- **Refrigerated Trucking**
- **Construction**
- **Daylighting**
- **Structural Batteries/Supercapacitors**
- **Clothing and Apparel**
- **Body Armor**
- **UAVs**

AVAILABLE FORM FACTORS

Airloy Ultramaterials are currently available in monolithic parts and panels with dimensions of 30 cm by 30 cm in thicknesses from 1 mm to 2 cm. Larger sizes are available on request. Airloy sheets/panels can be laminated together to achieve greater thicknesses or machined if thinner parts are desired. Airloys can be molded to spec or machined using conventional milling, turning, cutting, and grinding operations to create complex 3D parts demanded by engineering applications. They can also easily be glued and laminated to each other or other materials using cyanoacrylates, epoxies, and urethanes.

PERFORMANCE AND USABILITY

Airloy Ultramaterials are monolithic, dust-free, nanoporous materials that are homogeneous on the micro and macro scale. They are generally hydrophobic to superhydrophobic, and certain formulations exhibit high temperature tolerance, low- or non- flammability, and solvent resistance.

MATERIALS PROPERTIES

Series	Density [g/cc]	Young's Modulus [MPa]	Yield Strength [MPa]	Thermal Conductivity [W/m-K]	Operating Temp [°C]
X50	0.1 – 0.55	1 - 235	0.03 – 6	0.024 – 0.055	130
X60	0.4 – 0.65	220 – 620	5 - 16	0.024 – 0.055	130
X100	0.1 – 0.55	8 - 360	0.4 - 12	0.024 – 0.055	80
X110	0.07 – 0.55	5 – 220	0.2 - 11	0.020 – 0.044	300
X120	0.1 – 0.35	125 - 215	0.6 – 5	0.025 – 0.04	250
X130	0.16 – 0.55	1 - 400	0.04 - 6	0.030 – 0.060	130

EXAMPLE PRODUCT PROPERTIES

Material	Composition	Density [g/cc]	Operating Temp. [°C]	Thermal Conductivity [mW/m-K]	Comp. Strength (10% Strain) [MPa]	Comp. Modulus [MPa]	Ultimate Tensile Strength [MPa]	Elongation at Break [%]	Specific Energy Absorption [J/g]
X56-H	Silica/Polyurea Hybrid	0.25	130	25	3.4 - 3.9*	20	--	--	40
X103-M	Aliphatic Polyurea	0.2	80	26	2	38	5	18	30
X103-H	Aliphatic Polyurea	0.4	80	47	7.5	215	9	15	60
X114-M	Aromatic Polyimide	0.22	300	20.7	1.3	27	0.8	9	2
X114-H	Aromatic Polyimide	0.4	300	44	5.5	110	6.5	13	70
X116-L	Aromatic Polyimide	0.09	300	23	0.4	11	0.6	13	--
X126-L	Aromatic Polyamide	0.09	250	49	0.44	9.7	0.2	6	--
X126-M	Aromatic Polyamide	0.16	250	65	0.5 - 0.7	50 - 60	--	--	--
X134-MH	Aromatic Polyurethane	0.34	150	40.8	3.6	67.5	4	12	50

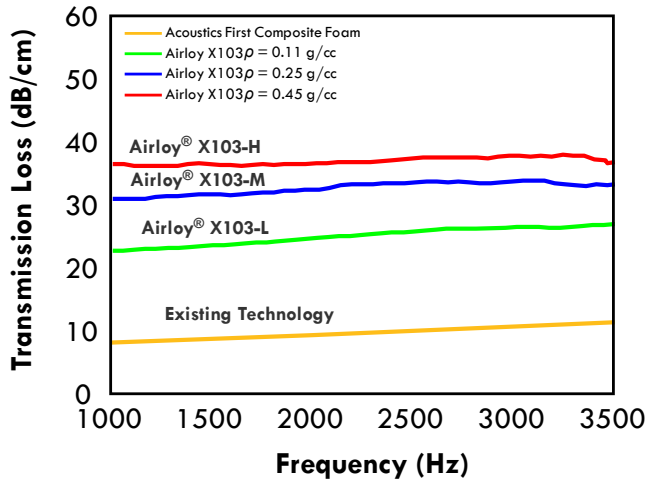
FLAMMABILITY

Preliminary results of material exposure to propane torch (flame temperature 1995°C) for ~30 s

Material	Composition	Flame Exposure Response
X56	Silica/Polyurea Hybrid	▪ Sustains small flame after torch is removed ▪ No observable dripping or smoke release
X103	Aliphatic Polyurea	▪ Material sustains flame after torch is removed ▪ No observable dripping ▪ Releases smoke
X114	Aromatic Polyimide	▪ Material chars but does not sustain flame ▪ No observable dripping or smoke release
X116	Aromatic Polyimide	▪ Material chars, self-extinguishes in <1-2 s after removal of torch ▪ No observable dripping or smoke release
X126	Aromatic Polyamide	▪ Material chars but does not sustain flame ▪ No observable dripping ▪ Releases a small amount of light-colored smoke
X134	Aromatic Polyurethane	▪ Material sustains flame, persists for ~5 s after torch is removed ▪ Drips and releases smoke

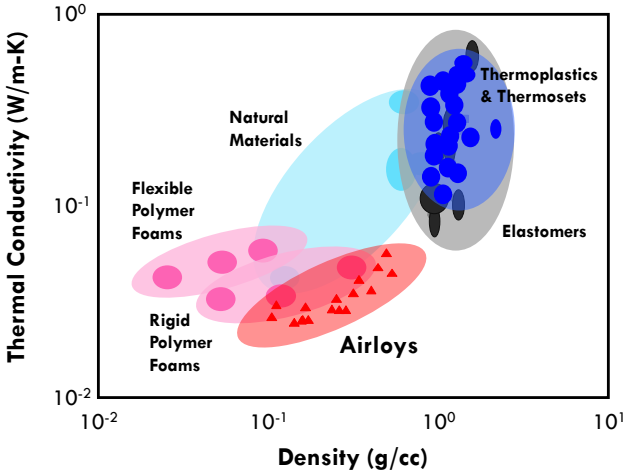
AEROGEL technologies®

ACOUSTIC PERFORMANCE

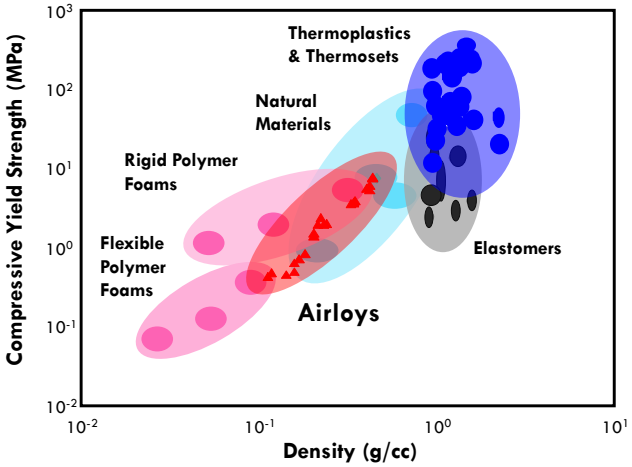


Thanks to their nanoporous structure Airloys provide superior sound transmission loss over traditional materials.

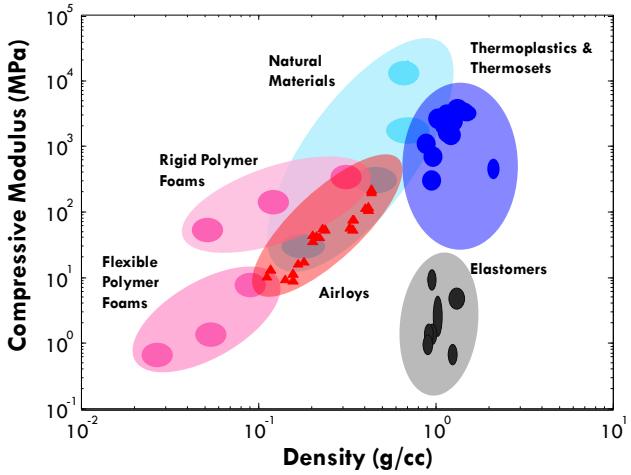
ASHBY CHARTS



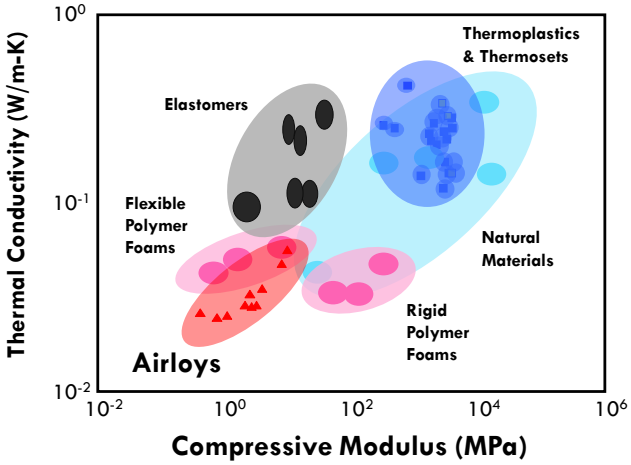
Airloys offer superior thermal insulating properties than traditional lightweight materials including polymer foams and wood while simultaneously offering excellent strength and stiffness.



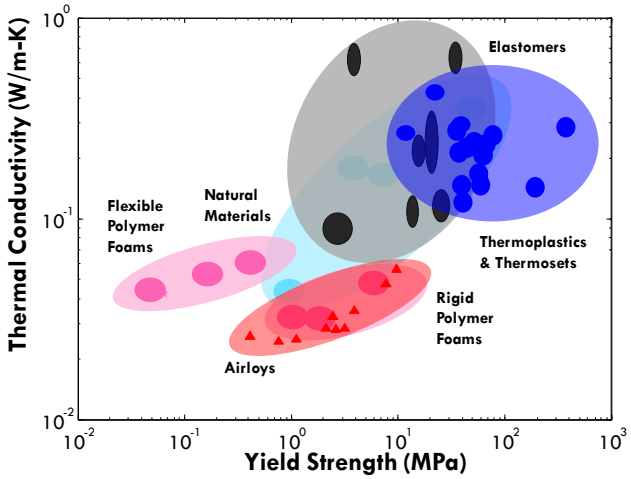
Airloys provide yield strengths comparable or superior to engineering foams and wood while providing ancillary advantages such as excellent sound damping, non-flammability, and unlike foams homogeneity.



Airloys occupy a stiffness gap between foams and traditional plastics while still providing the durability and machinability expected of engineering materials and thermal conductivity and acoustic damping advantages.



The properties of Airloys give them unmatched combinations of insulating advantages and stiffness compared to other engineering materials.



Airloys offer superior thermal conductivity at a yield strength equal to or better than rigid polymer foams but with the homogeneity and machinability of engineering plastics.