The Fiberglass Difference.

- High strength-to-weight ratio
- Low conductivity
- Resists warping
- Resistant to corrosion from chemicals and salt air
- Insulates from heat and cold
- Insulates from electricity
- Cost-efficiently can be made into complex shapes
- Coefficient of thermal expansion similar to glass
- Low thermal conductivity
- Dimensionally stable
- Rot resistant
- Easily paintable and re-paintable with minimum preparation
- Excellent insulators with high R-values and low U-factors
- Made from an abundant natural resource, silica sand
- Long product life
- Low life cycle costs
- Safely disposed since it is completely inert

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Advantages of Fiberglass Windows

Fiberglass framed windows and doors are high performance products that are more **energy efficient**, **longer lasting**, **stronger**, **more aesthetically appealing** and **environmentally friendlier** than typical wood, aluminum or vinyl windows.

What is Fiberglass?

Fiberglass is a composite structural material that consists of fiber reinforcements (typically glass) that are bound together in a resin matrix. Fiberglass has a high strength-to-weight ratio, resists warping and is resistant to environmental and chemical corrosion. It insulates from heat, cold and electricity, withstands temperatures from -40 to 350 degrees Fahrenheit and can cost-efficiently be made into complex shapes.

The unique properties of fiberglass include:

- Coefficient of thermal expansion similar to glass
- Low thermal conductivity
- Dimensional stability
- High strength
- Rot resistant
- Chemically inert
- Easily paintable and re-paintable with minimum preparation
- Low environmental impact – made of readily available silica sand
- Future recyclable capability

Over the past 10 years, fiberglass is used more and more in residential and light commercial construction. It is becoming the preferred material for window frames and door panels. According to Ducker Worldwide, fiberglass framed windows has been the fastest growing segment of the residential window industry for the past several years.

What makes Fiberglass "Green"

Fiberglass has earned a reputation as a smart choice for green building products because of its energy-efficiency characteristics. This is significant because buildings consume 30% of all of our nation's energy and 50% of all electrical energy. Using fiberglass products, including window and door frames, can help reduce the world's energy consumption.

Fiberglass windows and doors insulate extremely well. Their high R-values and low U-factors will save energy for decades. Filling the fiberglass frames with sustainable foam insulation and glazing the windows with high efficiency insulating glass creates an incredibly high-performing window.

To be a "truly green" the fiberglass product must be sustainable as well. The embodied energy in fiberglass is less than other common building materials such as PVC (vinyl) and aluminum. Fiberglass is made from silica sand, an abundant natural resource that is readily available almost everywhere. Fiberglass also contributes to long product life and low life cycle costs. These attributes are critical when creating a sustainable product.

Fiberglass products can contribute to National Association of Home Builders (NAHB) or Leadership in Energy and Environmental Design (LEED) credit programs. These programs assess building projects based on overall environmental impact and reward those that follow green building practices.

Fiberglass vs. Aluminum

Fact: For heavy commercial windows the only choice in the past was aluminum due to it's strength. Fiberglass windows now offer higher strength and more flexibility in design.

Fact: Aluminum is excellent for conducting temperature for applications like pots and pans, but for windows it is the worst material as you do not want to conduct temperature. Even the best thermal barriers are not effective in reducing the conductivity or energy loss.

Fact: Fiberglass provides the strength and low conductivity to optimize window design and maximize glass area.

Fact: Aluminum corrodes from salt spray in coastal locations. Fiberglass does not.

Benefits of Fiberglass Windows

Using fiberglass for window frame material is preferable to other window frame materials like wood, aluminum and vinyl, because fiberglass:

- Performs well in humidity extremes and hot and cold environments.
- Has high condensation resistance which helps keep humidity within a proper range and limits the growth of mold and mildew.
- Very low coefficient of thermal expansion and contraction (CTE).
  - Since fiberglass is mostly glass, it expands and contracts at about the same rate as plate glass.
  - Aluminum expands and contracts 3 times as much as fiberglass and vinyl moves over 7 times as much.
- Stress on seals, caulks and joints is minimized, contributing to higher efficiency windows.
- Tight seals maintain the resistance to air leakage and water penetration.
  - Seal failure can increase the risk of water damage or mold and shorten the life of the product.
- About 3 times stronger than aluminum and 9 times stronger than vinyl windows.
  - Strength decreases the limitation on glass size making large picture windows possible and energy efficient.
- Unlike wood framed windows, fiberglass does not rot or warp.
- Does not require a "thermal break" found in most aluminum windows.
- Does not require the stiffeners that many vinyl frames need.
- Easier to install
  - Frames stay square and do not twist or warp, a common problem during the installation of other types of windows.
- Practically maintenance free.
- Takes paint easily with excellent adhesion.
- Available in a large selection of colors.

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HOW-TO JUNE 27, 2017

Vinyl vs. Aluminum vs. Fiberglass: Not All Materials are Created Equal

Our second installment of window tips in partnership with the experts at** Fine Homebuilding(http://www.fi **tackles the list of popular window materials, and the pros and cons of using them in your next project.

Planning a new build, remodel or a window replacement project can be overwhelming, especially when there are many variations of window and door materials to choose from – and a lot of information to sift through in order to identify the material that best suits your needs.

While windows come in a variety of shapes and sizes to meet any design solution, it's important to be aware of each type's inherent performance attributes when selecting windows and doors for a home, especially when low-energy consumption is a goal. The most popular frame materials for windows and doors are vinyl, rolled or extruded aluminum (http://www.marvin.com/our-products/options/materials?menu=extruded-aluminum-clad), fiberglass (http://www.marvin.com/our-products/options/materials?menu=ultrex-fiberglass), wood (http://www.marvin.com/our-products/options/materials?menu=wood), and wood clad (http://www.marvin.com/our-products/options/materials?menu=extruded-aluminum-clad) with a more weather-resistant material on the exterior —either rolled or extruded aluminum, fiberglass, or vinyl. Each material has its pluses and minuses.

All-aluminum or clad, and extruded or roll-formed?

Aluminum can either be extruded or roll-formed, and the difference in strength can be compared to an industrial chair versus an inexpensive lawn chair.

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Extruded aluminum (http://www.marvin.com/our-products/options/materials?menu=extruded-aluminum-clad) is preferred for cladding because of its strength and weather resistance. Clad windows shouldn't be confused with windows that have all-aluminum frames, which are typically less energy-efficient than the alternatives.

What you should know about vinyl

The white elephant in the room is vinyl, which accounts for roughly two-thirds of all of the windows installed in the United States. It's even less expensive than aluminum, yet offers much better insulating values. That said, there are some good reasons to bypass vinyl, and to some extent even vinyl-wood composites, even if you are looking for long-term value.

Vinyl (and some composites) has poor strength, meaning it's prone to damage during installation and to warping over time. And its insulating capability is only moderate compared to wood (http://www.marvin.com/our-products/options/materials?menu=wood) and fiberglass (http://www.marvin.com/our-products/options/materials?menu=ultrex-fiberglass), even when its extruded chambers are filled with foam. Third, vinyl is prone to UV damage, making it a poor choice in the sunniest states. The vulnerability to heat and UV light is why vinyl windows are manufactured mostly in white and almond tones. Vinyl doesn't take paint well, so you'll be stuck with those white windows.

Vinyl also expands and contracts at a rate seven times greater than glass, which means that seasonal temperature swings can break the insulating seals around the panes, letting in air and moisture. It also has poor resistance to wear and tear, as well as the worst impact resistance of any frame

material. Despite that, today's vinyl windows are a vast improvement over the leaky, single-pane wood windows of yester-year.

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All-wood windows: beauty and strength with a little bit of maintenance

Next up the price chain are all-wood (http://www.marvin.com/our-products/options/materials?menu=wood) windows. Wood is strong and a good insulator, and it adds beauty inside and outside the home. It's important to keep in mind that all-wood windows do require regular maintenance, which adds to their cost.

If you neglect that cleaning and painting at any point, sun and rain can do permanent damage. This is why so many manufacturers offer a wood window clad with vinyl, aluminum, or fiberglass.

Fiberglass is unique

As a window-frame material, fiberglass offers an unmatched combination of energy-efficiency, durability, and long-term value. Integrity from Marvin's Ultrex pultruded fiberglass (http://www.marvin.com/integrity/features/ultrex-fiberglass?gclid=CjwKEAjwpdnJBRC4hcTFtc6fwEkSJABwupNiuiBlP5d949NuCPeRACsFs5rUQiDE7KbFVZstGm2X0BoCieHw_wcB), for example, is eight times stronger than vinyl and is coated with a thick acrylic finish so durable that it can be offered in dark colors without fear of UV degradation or fading.

With its very low conductivity, fiberglass is also the best insulator among window-frame materials. And it shrinks and expands at the same rate as glass, making its air-seals as durable as the rest of the unit. Its longterm stability also ensures that fiberglass windows will operate like new for decades to come.

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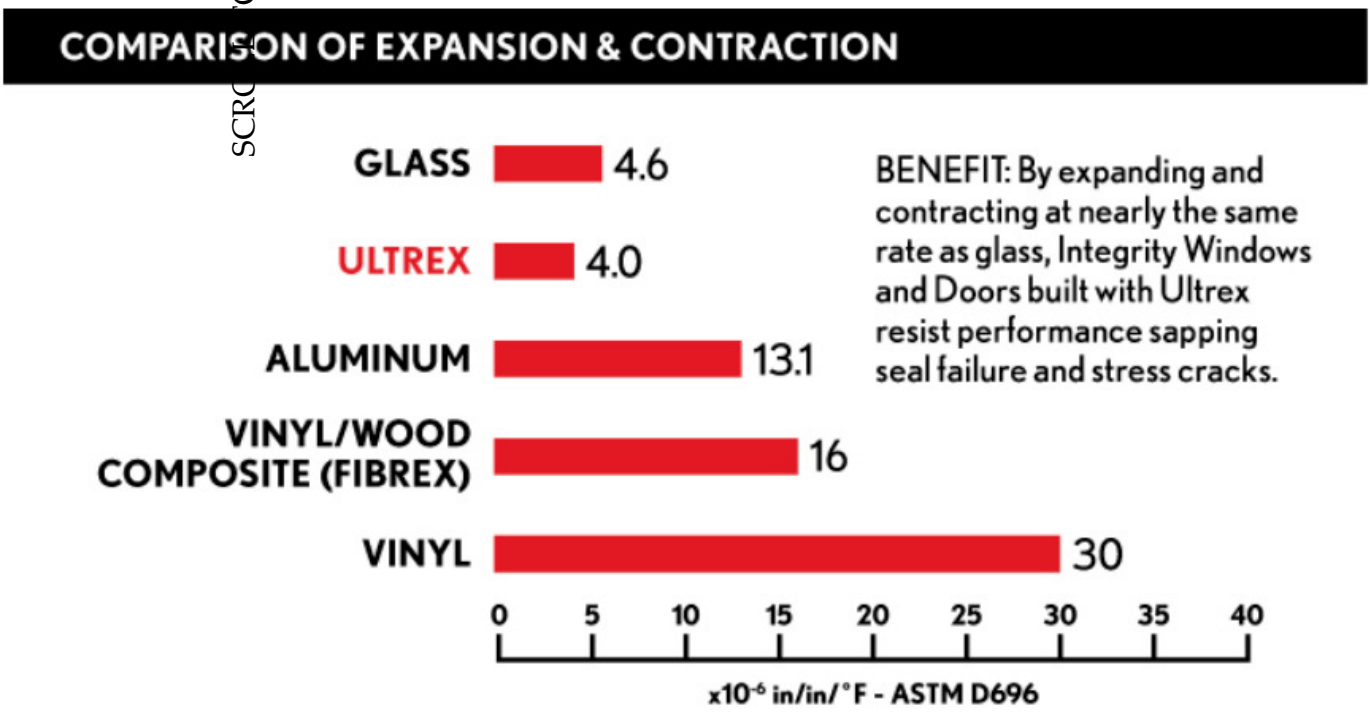

Fiberglass windows can be priced higher than vinyl, and a bit more than all-wood, but the payback in energy-efficiency, durability, and convenience makes it a strong contender for best value in the industry.

For Dave Veldhuizen, who builds low- and zero-energy homes in Eugene, Ore., it's hard to beat the practicality of U.S.-made fiberglass windows. "Integrity windows cost less than half as much as [superinsulated] European windows, and they don't require a six-month lead time when ordering." In fact, Marvin guarantees delivery to the local distributor within 10 days for all of its Integrity windows and doors, including special sizes.

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FIBERGLASS OUTPERFORMS ALTERNATIVES

Fiberglass windows, whether they're made completely of fiberglass or clad, have superior weatherization and insulation properties when compared to alternative materials. This makes them ideally suited for homes built in harsh locations and in homes that are taking energy-efficiency seriously.

There are two options for fiberglass windows: all fiberglass (http://www.marvin.com/integrity/features/all-ultrex-series) and fiberglass-clad wood (http://www.marvin.com/integrity/features/wood-ultrex-series). Full fiberglass models offer the best value of the two, while the clad models offer the timeless look of real wood on the interior of the home. Clad models also tend to offer the more high-end glazing options, like triple-pane glass, while all fiberglass has glazing options for every climate as well. Clad windows are the most expensive category, but they offer an unmatched combination of interior wood, energy-efficiency, and low-maintenance.

Durability and longevity

Aluminum and fiberglass are both superdurable outdoors, and each has its slight advantages. Aluminum offers more options, while fiberglass has the edge in overall strength and value. Both offer a wide range of near-weatherproof color coatings, which are bonded to the cladding during its manufacture.

Vinyl cladding is less expensive than the other two but has the performance and durability problems associated with all-vinyl and some vinyl-wood composite windows mentioned earlier. To be sure your clad windows are top-quality, check to see that there is no wood exposed to the outdoors, and check the specs to compare coatings between various brands. Look for a third-party rating.

This content originally appeared in Fine Homebuilding (http://www.finehomebuilding.com/) magazine.

Posted in How-To (https://blog.marvin.com/category/how-to/) and tagged aluminum windows (https://blog.marvin.com/tag/aluminum-windows/) fiberglass (https://blog.marvin.com/tag/fiberglass/) vinyl (https://blog.marvin.com/tag/vinyl/) vinyl windows (https://blog.marvin.com/tag/vinyl-windows/) wood windows (https://blog.marvin.com/tag/wood-windows/)

Advantages of Fiberglass Windows

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Details

The cutting-edge fiberglass framing systems of Alpen HPP offer superior performance to conventional fenestration materials in a number of ways: durability, stability and efficiency. Over the past 10 years, fiberglass has been used more and more in residential and commercial construction. It is becoming the preferred material for window frames and door panels.

Advantages of Fiberglass

Fiberglass-framed commercial windows offer significant advantages, both thermal and structural, over traditional aluminum, vinyl, or wood framing materials. These benefits include super-insulation, structural performance, lower embodied energy, and new design choice. According to the American Composites Manufacturers Association (ACMA) Pultrusion Industry Council and the American Architectural

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Manufacturers Association (AAMA) Fiberglass Material Council:

- Fiberglass' thermal conductivity is 800 times less than aluminum, making it the optimum material for super-insulating windows and preserving overall performance for the life of a window.
- Low thermal expansion maintains the windows' structural integrity and minimizes warping or leakage, making fiberglass the most durable framing material that will not compromise the performance of the full window over time.
- Fiberglass particularly resists environmental damage caused by corrosive salt air or high temperatures.
- Comparing U-factor of materials, fiberglass offers 89% better insulation than aluminum (fiberglass U-factor is 0.2 – 0.3 compared to aluminum thermally broken of U-factor1.0).
- Superior strength to weight ratios making Alpen Windows ideal for large window openings - 86% of the yield strength of aluminum and, pound-for-pound, stronger than aluminum in the lengthwise direction.
- Pultruded fiberglass distributes impact load to prevent surface damage even in sub-zero temperatures.

Material Comparison

The following chart compares general structural, thermal, and other characteristics of fiberglass, aluminum and wood, demonstrating the higher overall performance of fiberglass according to information from the Pultrusion Industry Council.

	Fiberglass	Aluminum	Wood
Corrosion Resistance	Superior weatherability and resistance to a broad range of chemicals.	Can cause galvanic corrosion.	Can warp, rot and decay from exposure to moisture, water and chemicals. Coatings or preservatives required to increase corrosion or rot resistance can create hazardous waste and/or high maintenance.

	Fiberglass	Aluminum	Wood
Weight	Very lightweight - about 70% the weight of aluminum on a density basis. Specific gravity = 1.7 Pultruded fiberglass has significantly higher strength-to-weight ratio compared to both wood and aluminum	Lightweight - about 1/3 that of copper or steel.	Specific gravity = .51 (oven dried).
Electric Conductivity	Non-conductive - high dielectric capability.	Conducts electricity - grounding potential.	Can be conductive when it is wet.
Thermal Conductivity	Insulates - low thermal conductivity. 0.17 BTU/h-ft-F 5.0 x 10-6 in/in/°F 100 in. sample at a temperature change of 100°F = 0.05	Heat conductor - high thermal conductivity. Pure Aluminum – 136.9 BTU/h-ft-F Alloyed Aluminum – 92.4 BTU/h-ft-F Thermal coefficient of expansion 11-13 (IN/IN /Fo)106.	Insulates - low thermal conductivity. Pine/Spruce/Fir/Larch /Mahogany (softwoods) – 0.08 BTU/h-ft-F Oak/Maple (hardwoods) – 0.09 BTU/h-ft-F Low thermal coefficient of expansion 2.5 (IN/IN /Fo)106.
Strength	Ultimate flexural strength (Fu) LW = 30 ksi CW = 10 ksi. Compression strength is 30,000 psi. Tensile Strength (KSI) 60.0 Modulus of Elasticity (PSI x 106) 3.0 Pultruded fiberglass has 86% of the yield strength of aluminum and, pound-for-pound's, stronger than aluminum in the lengthwise direction. Stiffness: Pultruded fiberglass is approximately 1-1/2 times as rigid as wood. Modulus of elasticity LW = 2.5 x 106 psi, CW = .8 x 106 psi.	Flexural strength (Fu) 35 ksi.	Extreme fiber bending = up to 2800 psi.* Compression parallel to grain = up to 1800 psi.* Stiffness: Modulus of elasticity = up to 1.8 x 106 psi.* Deteriorates with age

	Fiberglass	Aluminum	Wood
Finishing	Special colors available. Composite design can be customized for required finishes.	Silver color. Other colors require pre-finishes, anodic coatings and paints.	Must be primed and painted for colors. To maintain color, repainting and refinishing may be required.
Impact Resistance	Glass mat in pultruded fiberglass distributes impact load to prevent surface damage even in sub-zero temperatures. Will not permanently deform under impact.	Easily deforms under impact.	Permanently deforms or breaks under impact
Life expectancy	80+ years without any maintenance.	30 to 40 years less if exposed to a corrosive environment such as coastal environments and acidic rain.	15 to 20 years if properly maintained, sanded, sealed and refinished every year. Less if not properly maintained

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