# breathing windows

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#### inspiration

Animals **breathe** to maintain homeostasis, but plants "breathe" as well. Most leafy, green plants have **stomata** (small pores found on the leaf and stem epidermis), that are used for gas exchange. Air and water vapor can pass through the stomata, which is essential for photosynthesis and respiration. The opening/closing of the stomata is primarily regulated by the **sun** - the stomata are open when it is hot and sunny so that CO2 can pass into the plant for photosynthesis.

#### concept

What if a building could "breathe" likes plants to help conserve heat and thus operate more efficiently? The building could open pores in its walls to the exterior and could allow cool air from the outside in, when it is cooler outside than in the building, thus reducing cooling costs and energy usage.

In high-rises, many windows cannot be opened for safety reasons. Even buildings that seem to be made entirely out of windows do not have windows that actually open. Also, most people do not leave windows open overnight, which would help keep the building cooler during the daytime. The stomata-inspired breathable windows would help keep building homeostasis and cut energy usage over the life of the building, all just by reacting to nature.



stomata

### breathing window



#### product

Our building product works like this: There are two panes of glass for each window, each half the thickness of a window. Each pane has tiny holes. The two panes are slightly offset, so that the holes are not on top of each other and nothing can pass through. The panes are attached to the wall with different fixture supports made of different materials or different thermal expansion rates. When the temperature outside is lower than that of the inside temperature, it will cause the fixture of the outside pane to shrink at a different rate than the inside pane. As such, one pane will move along the other until the holes in each pane overlap, and a breeze can flow through the window. When the temperature differential decreases, and it is not desirable for the building to breath, (as it would lose indoor temperature to the outdoors, the windows shift back and the holes no longer overlap.



At first glance, it seems that CPVC might be a good material for our purposes. It has a Thermal Expansion of 0.000456 inches per inch of material per degree Fahrenheit. That means that with 6 inches of CPVC, and a 10 deg F temperature difference the glass would move 0.02736 inches, and 1 deg F difference would warrant a 10 thou expansion. Although CPVC is the least harmful PVC, it is not particularly "green" and therefore not ideal.