

**X International Conference on Textile Composites and Inflatable Structures
STRUCTURAL MEMBRANES 2021**

IS Energetic Aspects of Building Envelopes organized by Prof. Dr.-Ing. Karsten Moritz

Passive Radiative Cooling

Timothy J. Hebrink

3M Corporate Research Process Laboratory, Maplewood, MN 55144, USA
E-Mail: thebrink@mmm.com, Web page: www.3M.com

***Sebastian Zehentmaier**

3M Advanced Materials Division, Dyneon GmbH, 84508 Burgkirchen, Germany
E-Mail: sfzehentmaier@mmm.com, Web page: www.dyneon.eu

ABSTRACT

Passive Radiative Cooling is a technology that allows to passively radiate heat away from a building's or heat exchanger's surface. Heat emission is most effective in a wavelength range from 8 to 13 microns, in which the atmosphere does not absorb radiation (atmospheric window), we call this Sky Cooling.

The thermal radiation from the sun is about 1000 W/m² whereas the thermal radiation from a surface to the sky is in the range of 50 – 150 W/m². Hence, Sky Cooling was not possible during the day so far as solar absorption by the sky facing surface overwhelmed any radiative cooling effect. Using a uniquely constructed, weather resistant polymer film, the sky facing surfaces can be modified in a way that they both reflect the sunlight and emit heat to the sky, even when the surface temperature is below the ambient air temperature.

This technology works around the clock, consumes no water and makes no noise. The electricity savings potential can be around 500 kWh/m²/year. Even faster payback is achieved when coupled with cooling systems that operate every day of the year such as refrigeration/freezer systems. Manufacturing plants having processes that generate heat often have HVAC systems that operate every day of the year. Thus, this technology can actively help to reduce greenhouse gas emissions and freshwater use.

The figures below illustrate the major facts.

