Effectiveness and Assessment of Aerogel Use and Light Variablity on Thermal Collection

Eric Kim

Shaker High School, Latham, NY, United States of America

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This study aimed to investigate the potential of using aerogel and/or glass covers to enhance solar thermal systems' efficiency and capacity through the greenhouse effect. ~95% transparent monolithic silica aerogel, which consists of up to 99.98% air and can withstand high temperatures without losing structural integrity, was considered as a possible artificial greenhouse medium. The study employed a controlled experiment to compare temperatures and effectiveness in various positions and treatments combining aerogel and/or glass. The experiment used a black 0.45mm copper sheet absorber, 2mm Plexiglas, 2mm silica glass, 5mm monolithic silica aerogel with ~95% transparency, aluminum sheet cover, cryogel insulation, and 500-watt halogen lamps to simulate solar flux. The use of aerogel clearly demonstrated a greater solar thermal efficiency and capacity than other transparent covers. However, Plexiglas or silica glass added on top of the aerogel hindered some light from reaching the absorber, resulting in temperatures that were slower to rise than those without the cover. The results suggest that there must be a cover to protect the aerogel's fragility and hydrophilicity, but current options, such as Plexiglas or glass, hinder the system's efficiency. Overall, this novel system suggests a viable sustainable alternative to existing costly and environmentally harmful methods of thermal energy collection, contributing to the understanding of how application of aerogel and/or glass covers using the greenhouse effect can lead to a greater solar collection of thermal energy.

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