Thermostatic bimetal integrated facade as a micro-climate controller

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ABSTRACT: Building energy conservation has attracted much attention as there has been an increasing trend for glass façades. Glass facades offer a positive psychological effect and aesthetics, but lead to a correspondingly high energy transfer both in summer and winter. One of the most effective strategies to enhance energy conservation is to use shading devices to reflect heat energy before it enters the building while maximizing daylighting penetration. In this particular research project, a thermostatic bimetal screen was configured within a double glazed system, acting as a passive shading device. Thermostatic bimetal is a product more commonly found in thermostats or other temperature sensitive devices, but has yet to find much application in a building façade. The compound material, composed of two or more alloys with highly varied coefficients of thermal expansion, allows passive movement as one side expands more than the other. This process is well documented, and can be highly calibrated to different temperature ranges by varying the length, thickness, or alloys of the material.

The primary goal of this project is to carry out preliminary performance analysis of a bimetal shading device and to demonstrate its sustainability potential for contemporary glass facades. Building energy simulation was utilized as a research methodology to quantify energy saving from bimetal and compare it with a typical code complying building. The energy simulation focused on cooling and heating loads for a typical summer design week and winter design week respectively. Additional lighting analysis was carried out to show daylighting potential from a bimetal shading device. The preliminary analysis revealed that there was 15~20% reduction in cooling and heating load from a bimetal shading device compared to a code compliance building. Bimetal shading device provided approximately 500lux daylighting level along building perimeters. Additional environmental benefits from the bimetal shading device include occupant comforts by balancing solar gain and daylight penetration while providing glare control and view-out. Detailed system development and performance assessment will be presented in the conference.