Environmental Control and Information Exchange through Responsive Building Membrane Technology

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ABSTRACT

Developments in dynamic glazing technologies have made moderate progress towards greater energy efficiency for curtain wall systems. These existing technologies are limited in their performative response to bioclimatic and programmatic conditions because of their inability to precisely adjust to the continuously shifting geometry and intensities of the solar resource. Recent developments in emerging display technology may provide opportunities to transfer technology to glazing systems that can achieve high levels of geometric and spectral selectivity through the building membrane in order to meet lighting, thermal and informational requirements of occupied spaces. The distribution of dynamically controlled display technologies throughout exterior and interior surfaces may provoke new types of social engagement as they significantly improve building performance, allowing light to define emergent boundary conditions. This thesis focuses on the examination of these criteria through experimental prototyping and testing of electroactive polymers within glazed envelopes and interior surfaces, using the development of a typical office complex in New York City as a testbed site, whereby performance is simulated and evaluated according to multiple environmental and social criteria including thermal comfort, daylighting quality, variable privacy and dynamic visual effects.