Improving Energy Efficiency and Reducing Our Carbon Footprint: A Novel Approach for Fabricating Inexpensive Electrochromic Coatings for Smart Windows

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Buildings consume 30-40% of the global energy produced today. A large portion of building energy is used by HVAC systems to overcome energy lost from buildings through windows. Studies show that 70-90% of this energy can be saved through energy efficient technologies. One way to reduce energy consumption of buildings is by using Smart Windows. Smart Windows reduce building energy losses by reducing or eliminating infrared radiation entering or leaving a building while providing the user complete control over the amount of visible light entering the building. Currently, these Smart Windows are made of materials and/or use processes that make then extremely expensive for wide spread use. In this project a new approach, called Spray Enhanced Atomization Based Spin-coating with Limiting Interfacial Reaction (or SEAS-LIR) approach, for making smart windows coatings from inexpensive materials was developed. The SEAS-LIR approach overcomes some of the major shortcomings associated with Prussian blue coatings. The surface morphology and stability/electrochromic switching of the films were studied using Helium Ion Microscopy (HIM) and cyclic voltammetry techniques. The HIM results show that the films are extremely porous; this is extremely important since it allows easy incorporation and expulsion of the balancing ion during electrochemical switching. Cyclic voltammetry data showed that over 50 cycles, the films lost less than 0.1% of their capacity. In addition, a preliminary cost estimate shows that the approach developed in this project will reduce the cost of fabricating the smart windows by one order of magnitude (from >$100/ft2 to ~$10/ft2). This new process, when implemented, will dramatically reduce the energy consumed and hence reduce our carbon print.

Awards Won:

Second Award of $2,000