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Methods to Improve Cycling Stability of Electrochromic Thin Films

Surface-toughened, nanoparticle-reinforced films resist cracking and wear, enabling longer-lasting smart windows and displays.

Researchers at Purdue University have developed new ways to improve cycling stability for electrochromic thin films. Cyclic changes in electrode size known as mechanical breathing occur during the use of electrochromic thin films, often contributing to material wear and disintegration because of the film's organic nature. In fabricating these films, oxidation is used to increases surface volume, but it can subsequently cause loss of material hardness. This physical alteration consequently amplifies existing material softness. Purdue researchers have been able to create a surface toughening technique that strengthens the interface where delamination occurs following oxidation. In addition, surfaces can be roughened with silica nanoparticles to enhance toughness. In testing with electrochromic thin films made from various polymers, pristine condition has been obtained over 160 cycles without any indication of strain, edge cracking, or detrimental wrinkling. This approach to creating reliable electrochromic thin films can be implemented in smart windows.

Advantages:

-Strength

-Durability

-Cost-efficiency

-Reliability

Potential Applications:

-Smart windows

-Electronic displays

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Chemicals & Advanced Materials/Polymer Science & Smart Materials

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Further information

Will Buchanan
wdbuchanan@prf.org

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