Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supporting Information

Electrically tunable infrared reflector with adjustable bandwidth broadening up to 1100 nm

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Fig. S1 Photograph of the IR reflector at various voltage demonstrate the transparency in the visible region.

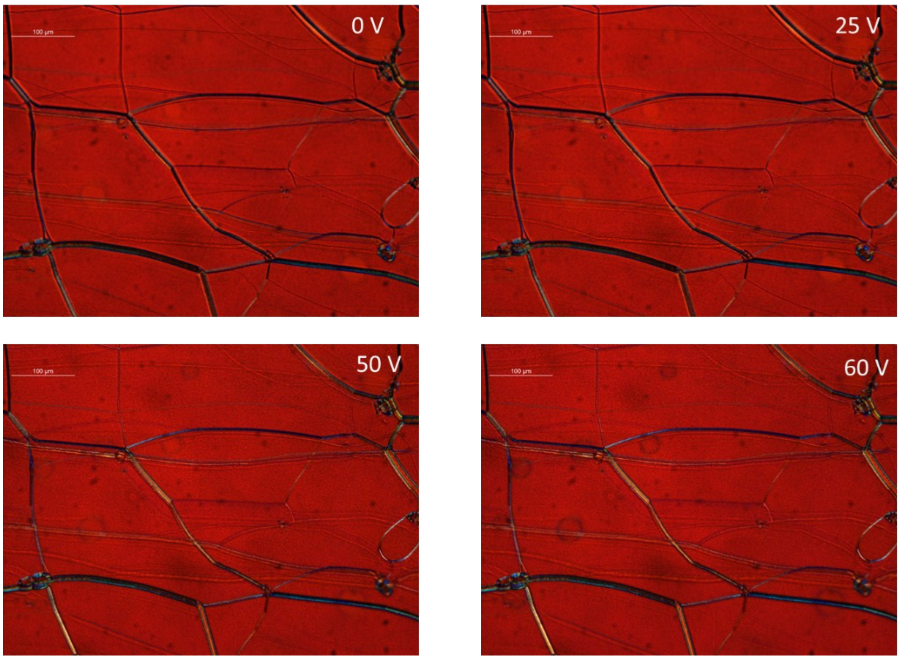

Fig. S2 Polarization optical microscopic (POM) images of the IR reflector at various applied DC voltage.

Table S1. A rough estimate of different fractions of infrared light that may be reflected on application of different voltage. [1]

Applied voltage	Amount of IR light reflected using smart tunable window (50% reflection of light)
0 V	8.06 %
10 V	8.06 %
15 V	8.06 %
20 V	9.14 %
25 V	10.13 %
30 V	12.05 %
35 V	16.83 %
40 V	22.47 %
45 V	28.97 %
50 V	34.82 %
55 V	40.81 %
60 V	45.40 %

Calculation for energy savings

Recently we have shown that the benefit of energy savings using a smart window, in the built environment, is optimum in the climate which has both good summer and winter. [2] Therefore, we have chosen to study the impact of smart tunable window in Madrid, Spain climate conditions. Here we have calculated the energy that could be saved by electrically tunable smart window including the power needed to run and maintain it, by assuming that the performance of smart tunable window is at least as good as switchable IR reflector [2].

- The amount of energy that is spent in the office building on heating, cooling and lightning using the standard double glazing window = 126.1 $kWh^{-1}\,m^{-2}\,yr^{-1}$
- Energy saved by the electrically switchable window excluding the power needed to run the window = 15.5 $kWh^{-1}\,m^{-2}\,yr^{-1}$ = Energy saved by the smart tunable window excluding the power needed to run the window (assumption, as the band width of the light reflected in both the cases are same)

- Number of hours spent by smart window in broad reflection state: ~1300 hours

- Energy consumption in a year to run and maintain the tunable window :
  = Power required by the window (see manuscript) × no. of hours to run the window in a year
  = 0.1207 × 1300 $Wh^{-1}\,m^{-2}\,yr^{-1}$
  = 0.157 $kWh^{-1}\,m^{-2}\,yr^{-1}$
  (~ 0.1% of the total power spent in a year on heating, cooling and lightning)

- Total energy saving using electrically tunable smart window including the power needed to run the window is :
  = (energy saving – power needed to run the window)
  = (15.5 - 0.157) $kWh^{-1}\,m^{-2}\,yr^{-1}$
  =15.34 $kWh^{-1}\,m^{-2}\,yr^{-1}$
  (12.2% of total energy consumption)

Hence, above calculation shows at least 12% of the energy can be saved on cooling, heating and lighting in the built environment on using smart tunable compared to standard double glazing window.

Reference

[1] Calculated from the data given at the wedsite of National Research Energy Laboratory, http://www.nrel.gov, USA.

[2] H. Khandelwal, R. C. G. M. Loonen, J. L. M. Hensen, M. G. Debije, A. P. H. J. Schenning, *Sci. Rep.* **2015**, *5*, 11773.