Supplementary Information

Supplemenatry Note 1. Energy saving calculation

Energy-saving calculations were conducted using EnergyPlus version 9.4. A standard office model with a dimension of 6 m (width) × 8 m (length) × 2.7 m (height), having two windows with 3 m (width) × 2 m (height), was considered for simulation. The model was simulated with either the optimized transparent radiative cooling (TRC) windows or conventional class windows. The target cooling temperature was set to 24°C with all other default settings maintained, except for the optical properties of the optimized TRC windows (solar transmittance: 0.6650, solar reflectance: 0.3350, visible transmittance: 0.8749, visible reflectance: 0.1251, IR transmittance: 0.3860, and hemispherical emissivity: 0.5357). Sixteen U.S. cities (Albuquerque, Atlanta, Austin, Boulder, Chicago, Duluth, Fairbanks, Helena, Honolulu, Las Vegas, Los Angeles, Minneapolis, New York City, Phoenix, San Francisco, and Seattle) and sixteen international cities in temperate or tropical climates (Beijing, Berlin, Geneva, Incheon, London, Prague, Sapporo, Ulaanbaatar, Addis Ababa, Bangkok, Colombo, Harare, Havana, Nadi, Salvador and Singapore) were selected to calculate the energy consumption for cooling. Weather data for these cities were obtained from the EnergyPlus website.

Supplemenatry Figures

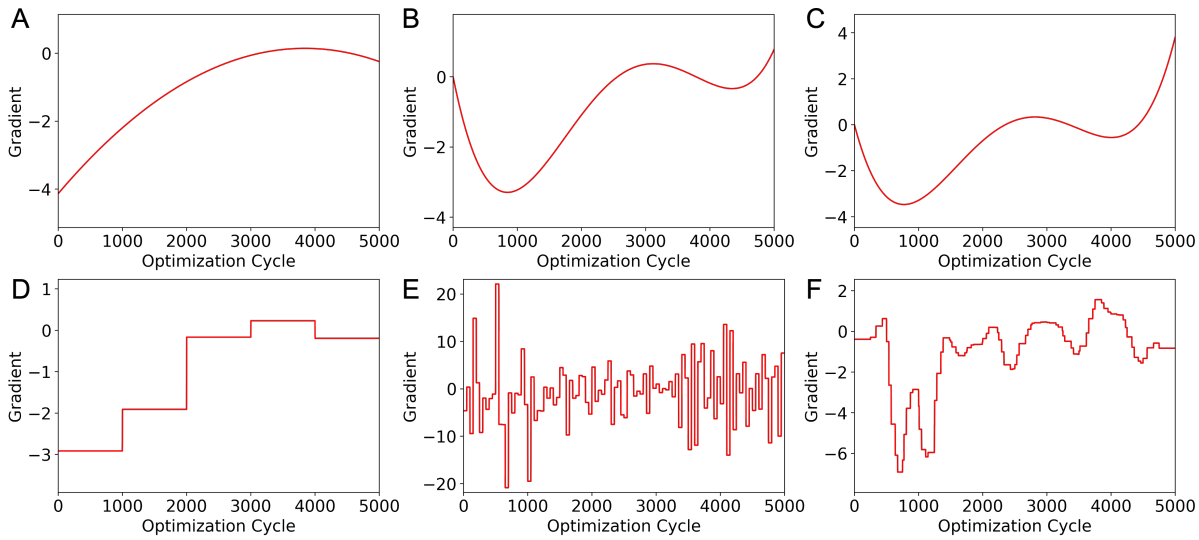

Figure 1: The analysis on the gradient of regression plots to determine the convergence initiation points. (A,B,C) The gradient of polynomial regression lines for Figures 2A, B, and 2C. (D,E,F) The gradient of piecewise regression lines for Figures 2D, 2E, and 2F.

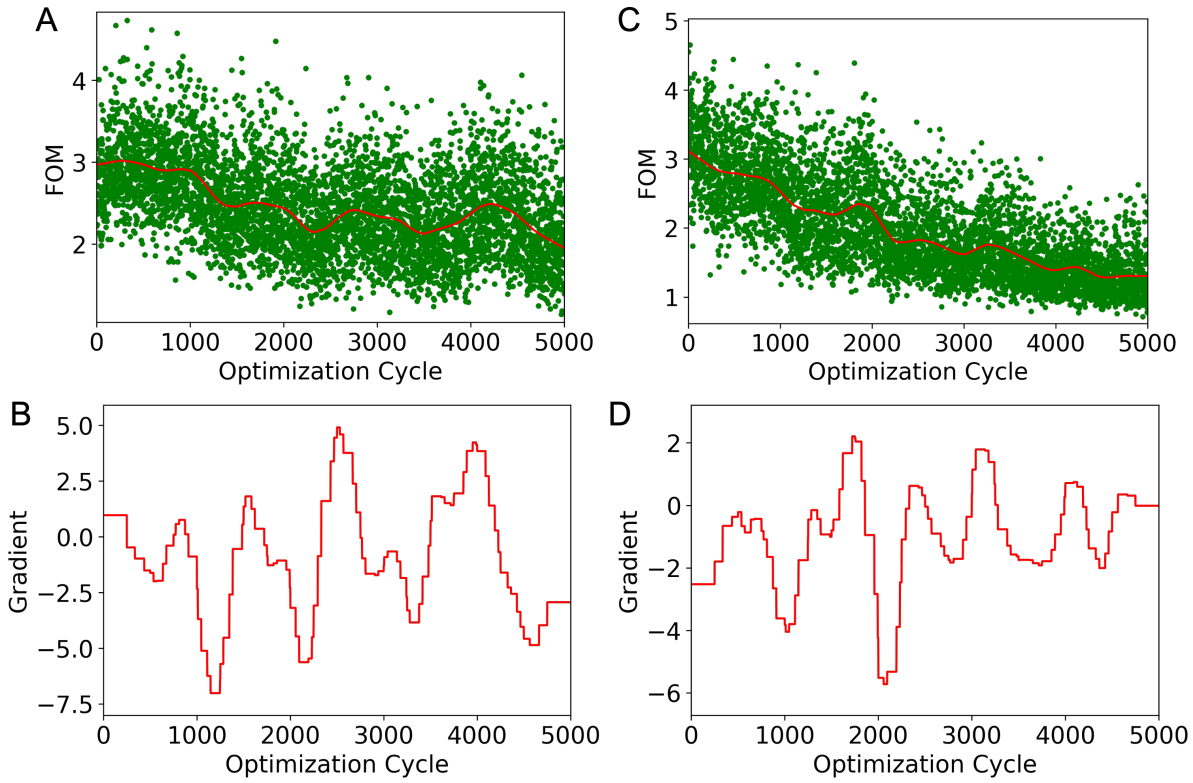

Figure 2: Optimization results after 5,000 iterations of active learning for a 160-bit system (80-layered TRC). Optimization starts with (A,B) 25 and (C,D) 3,000 initial data. (A,C) FOM distributions (green dots) and regression lines from averaged piecewise linear regression (red lines), and (B,D) corresponding gradient of the regression line.

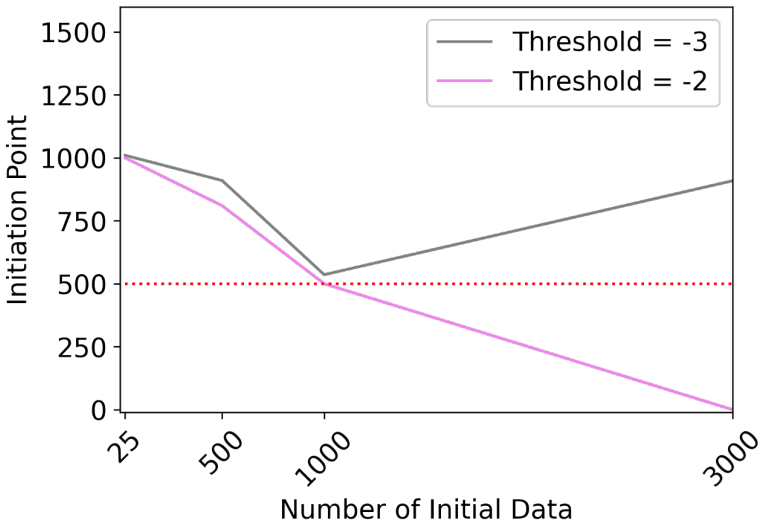

Figure 3: Initiation points where convergence starts as a function of the number of initial data for a problem size of 160 (i.e., 160-bit system / 80-layered TRC window). The initiation points are determined by the predefined threshold (-3 or -2).

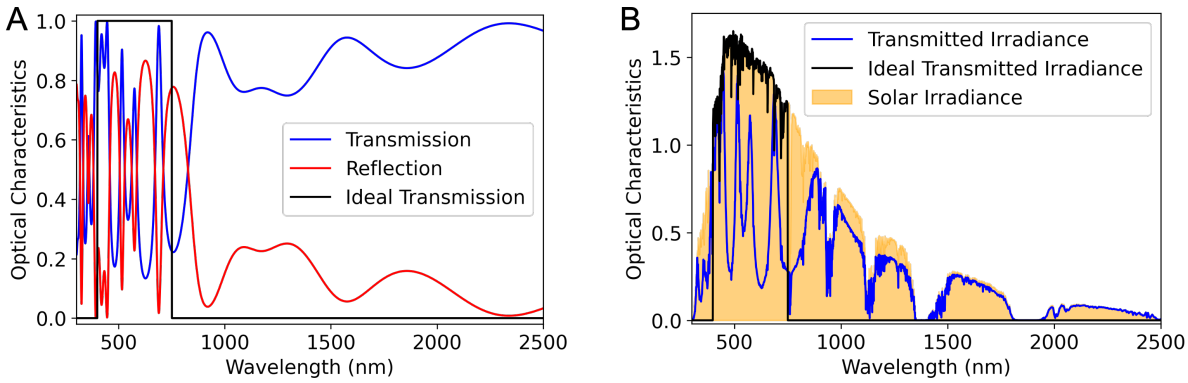

Figure 4: Randomly designed 30-layered TRC window (60-bit system). (A,B) Optical properties of the random TRC window. A binary vector representing this random TRC window is [00 00 11 01 00 11 11 00 10 11 11 01 10 00 01 01 11 11 01 01 11 10 01 10 11 11 01 00 11 10] and its FOM is 3.9389.

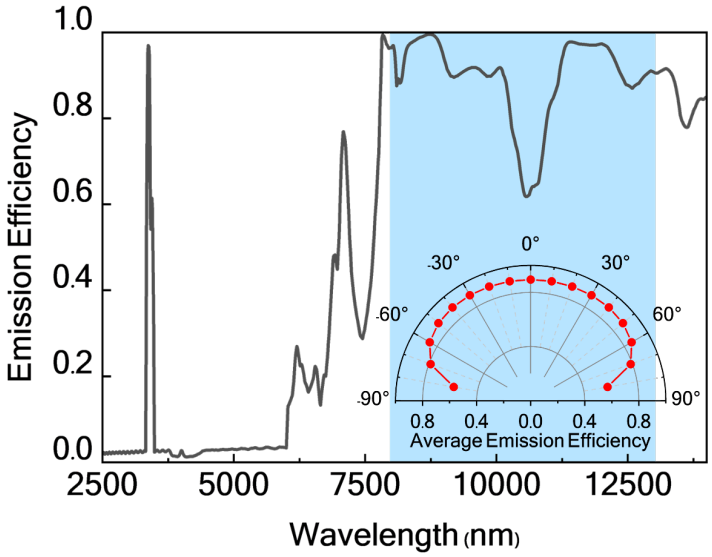

Figure 5: Calculated emission efficiency of the optimized TRC window under normal incident light. Inset presents angular emission efficiencies in the atmospheric window (λ= 8 to 13 μm) of the TRC window.