

Smart Windows and Façades – State of the Art and Future Directions in Europe

Abstract

The building sector in Europe accounts currently for almost 40% of overall energy consumption, and is number 1 energy consumer before transportation (33%), industrial processes (21%) and agriculture (2%). Significant reduction of the energy demand is a must, but it requires numerous measures: improved construction and design for less energy consumption through HVAC in each climate zone and each building type, decentralized energy supply from regenerative sources like solar, PV, geothermal to achieve nZEB characteristics, and last but not least, new windows and facades with reduced “grey” energy content and Smart Windows which enable passive as well as active control of visible light supply and solar gain to reduce heat loss and decrease size of HVAC installations.

The paper gives a brief review of current development projects within R&D programs on European level in the area of Smart Windows and Facades. Different approaches are presented: components and systems for significant reduction of embodied energy in windows and facades based on new lightweight materials with tailored optical, mechanical and thermal properties, actively controllable components for solar gain reduction using thermo- and electro-chromic glazing, active mirrors, Phase Change Materials (PCM's) to store thermal energy, wave length selective coatings as well as Vacuum Insulated Glazing (VIG).

Examples of standalone or combined techniques will be given, with particular emphasis on multi-functionality of such systems. The overall goal is to attain the physical limit of U-value for multiple glazing, and at the same time to optimize the Visible Light Transmission (VLT), and mechanical and acoustic properties of components based on thin glass pane laminate glazing. Examples of different passive and active components for windows and Insulating Glazing (IG) units will be presented as well approaches to reduce costs of such windows using efficient production technology.

Finally, aspects of Life Cycle Environmental Analysis for such new components and systems will be addressed as well as methods to evaluate the energy savings potential of different technologies based on new window components.

Keywords: smart components, thin glass panes, laminated glazing, multi-functionality, embodied energy, solar gain, latent heat, coatings, LCEA, energy savings.