Fabrication and characterization of triple vacuum glazing at low temperature using an indium-based seal

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Triple vacuum glazing (TVG) is a new generation of thermally insulating windows which consists of three glass sheets with two vacuum gaps hermetically sealed together around the edges. A high level of thermal insulation is achieved by evacuating the spaces between the glass sheets to a very low pressure; the low pressure greatly reduces conduction and convection within the space, therefore heat transfer through vacuum glazing is significantly lower when compared with double or triple glazing with an inert gas fill. The separation of the sheets which would otherwise touch under the influence of atmospheric pressure is maintained by an array of small support pillars. Triple vacuum glazing samples were fabricated at low temperature using an indium edge seal; a pump-out system enabled a high level of vacuum to be achieved between the panes. The TVG samples fabricated in this study comprised three, 4 mm thick 400 mm by 400 mm glass panes with low-emittance coatings separated by an array of stainless steel support pillars spaced at 25 mm with a diameter of 0.4 mm and a height of 0.15 mm. The thermal performance of the TVG samples were characterized using a guarded hotbox calorimeter and theoretically analyzed using a finite volume model. The experimentally determined thermal performance of the fabricated glazing was in good agreement with that predicted theoretically.

Keywords: triple vacuum glazing (TVG); double vacuum glazing; pump-out; thermal performance; finite volume model