Experimental and numerical investigations of the effect of nano-coatings of window glazing on thermal behavior of buildings in Saudi-Arabia

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This study was undertaken to investigate the thermal behavior of nano-coatings of window glazing in a glazed test room for the regional conditions of Saudi-Arabia. Well controlled antimony doped tin oxide thin films on glass substrates were prepared using the aerosol-assisted chemical vapor deposition process to evaluate the films for solar control glazing applications. The optical and thermal properties of the films were measured and systematically investigated. The influence of antimony doping levels on absorption and reflection of solar radiation is examined with respect to the optical properties in the visible and near infrared spectra range. Glass U-factor, Solar Heat Gain Coefficient (SHGC), temperature distribution and net heat transfer through the glazed walls inside the room were calculated through numerical simulations. The experimental and numerical results obtained indicate that the nano-coating thickness and doping level concentration of ATO has pronounced effect on the thermal insulation of the window glass. It was noted that the overall transmittance of solar radiation in the visible, infrared and ultraviolent spectra regions decrease with increase of doping level of antimony tin oxides and increase of coating thickness. It was observed that the net heat transfer through the glazed walls of room decreased exponentially with increase of coating thickness or doping level concentration. Finally, from the analysis of results it was concluded that the antimony doped tin oxide thin films show outstanding optical and thermal properties and in comparison, to commercially available glazing, an improved solar blocking behavior is observed for nanostructured ATO thin films.

Speaker Biography

Ahmed M Almogbel has over fifteen years of teaching in research, management and training in different areas of mechanical engineering, including power, materials, design and manufacturing. He has 15 technical papers to his credit and supervised 7 graduation projects in various areas of heat transfer, fluid mechanics, air conditioning manufacturing and science of materials. He is specialized in air conditioning systems, human thermal comfort inside the building envelope and thermal insulations. He is currently conducting applied researches in solar air-conditioning system, desiccant-evaporative cooling technology, and energy performance optimization for hot and dry air conditioning systems. Ahmed is the principle investigator for the running strategic project in KACST about the solar adsorption air conditioning system.

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