

EFFECT OF THE VARIABLE POROSITY ON THE HEAT TRANSFER PROCESS IN SOLAR AIR RECEIVER

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Solar air receiver is the core component of central receiver system (CRS) in solar thermal power plants due to the unique feature of some porous medium like silicon carbide foam ceramic and so on. In the air receiver, the porous material receives the concentrated sunlight from the heliostat field and heats up the pumped inlet air by convection and radiation. The incident radiation is distributed in the inner space of the porous medium rather than located on the boundary of the heated face in the front of the receiver. Aiming at this phenomenon which called volumetric effect, we propose a novel solar air receiver using the porous medium with variable porosity along the incident direction to optimize its heat transfer process and increase the thermal efficiency of the receiver. For this kind of porous medium, the effect of the variability of the porosity ϕ on the temperature and radiative heat flux distributions and also the thermal efficiency of the air receiver will be analyzed systematically. Our analysis demonstrated that the structure with variable porosity will enhance the transfer of radiative energy into the porous medium, consequently decreases the thermal radiative loss at the inlet and increases the thermal efficiency of the air receiver.