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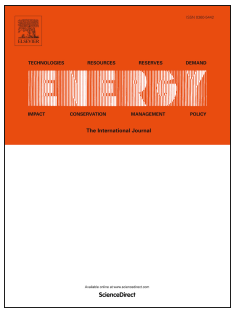

Performance study and comparative analysis of traditional and double-selective-coated parabolic trough receivers

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Performance study and comparative analysis of traditional and double-selective-coated parabolic trough receivers

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Abstract: Based on the simulated non-uniformity solar radiation flux distribution of the absorber by the Soltrace software using the Monte Carlo Ray-Trace Method, an innovative parabolic trough solar receiver that employs two solar selective coatings with different properties on the outer surface of the absorber is proposed. The concentration ratio and absorber temperature that influence optimal cut-off wavelengths of the solar selective coatings are quantitatively analyzed to optimize the property of the coating. The optimal cut-off wavelength increases with the concentration ratio, but drops with the increasing absorber temperature. The heat transfer process of receivers is numerically simulated to predict the thermal performance of evacuated receivers based on spectrum parameters heat transfer model. Heat loss simulation results show that: the double-selective-coated receiver can reduce heat loss and boost the collecting efficiency significantly compared with PTR70 receiver. When the temperature of absorber is 500 °C, the double-selective-coated receiver can reduce heat loss by 157.8 W/m and increase the collecting efficiency from 64.7% to 68.1%. The System Advisor Model annual simulation results indicate that double-selective-coated receivers can decrease the levelized cost of electricity of concentrating solar plants by 2.78%–7.34%, and increase electricity production by 2.94% – 8.21% compared with traditional PTR70 receivers.

Keywords: CSP; PTC; Parabolic Trough Receiver; Solar selective absorbing coating; Heat loss;