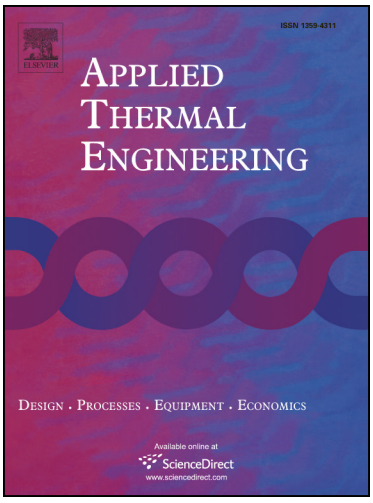

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Potential of Solar Reflective Cover on Regulating the Car Cabin Conditions and Fuel Consumption

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Abstract

The cabin soak temperature represents one of the biggest problems plaguing car owners during hot days. This is exacerbated due to limited shaded parking spaces and its high associated cost should one be available. This study intends to investigate the impact of available passive approaches on regulating car cabin conditions and evaluate the potential of solar reflective cover (SRC) for temperature reduction and fuel consumption. Four soaking temperature cases were tested i.e. Case I: using two identical cars simultaneously (internal solar reflective films (SRF) vs. Baseline); Case II: using one car at different times (with/without SRC); Case III: using two identical cars simultaneously (SRC versus internal SRF); and Case IV: using two identical cars simultaneously (with/ without SRC). Interior cabin parameters were monitored by HD32.3A during soaking and cooling tests to evaluate the cabin air temperature reduction and occupants' thermal comfort. The study revealed that an Aluminum cover on the cabin glazing and roof (case II) is the most effective approach, as it significantly reduced the cabin air temperature (by 17.7ºC). In this study, the lower/upper cabin comfort temperature limits were found to be ~25.5 and 27.15°C, respectively, as per the Fanger model. The thermal comfort level (27ºC) was attained at minute 7 by the cabin with SRC, whereas the baseline car attained the thermal comfort at minute 14 in the cooling-down test of case II. Covering the whole cabin with SRC can significantly decrease car cabin temperature when parking, which makes it viable as a benchmark for other passive approaches.

Key words: passive solar reduction load approach; Aluminum cover; vehicle cabin temperature; thermal comfort; Automobile air conditioning and fuel consumption