Experimental investigations on the thermal insulation performance of endothermic opacifier (Al_2O_3@Al-Si) doped silica aerogel at large temperature differences

Hao-Qiang PANG, Hai-Bo XU, and Zeng-Yao LI*

(*MOE Key Laboratory of Thermo-Fluid Science and Engineering, Xi'an Jiaotong University, Xi'an, 710049, China*)

Email: pang.1991314@stu.xjtu.edu.cn

Abstract: In order to reduce the radiative heat transfer of silica aerogels at high temperatures, different types of opacifiers are doped into silica aerogels. However, it is not easy to further improve the thermal insulation performance of silica aerogels by doping classical opacifiers for short-term thermal insulation. Phase change material (PCM) can absorb large amounts of heat while maintaining a nearly constant temperature during the melting process, which could be effectively used to delay the heat transferred inside thermal insulation materials. So, combing the classical opacifiers and PCM is a reasonable solution to the thermal insulation of silica aerogels at high temperatures or large temperature differences. In the paper, the endothermic opacifier with the shell of Al_2O_3 and the core of Al-Si alloy is prepared and then doped into silica aerogels. The temperature response of the hot surface of this endothermic opacifier doped silica aerogel (EOSA) is tested while the temperature of the cold surface keeps constant, and the hot surface is electrically heated with constant heat flux. The thermal insulation performance of EOSA is further analyzed and evaluated.

Key Words: Silica aerogel; Opacifier; Phase change material; Al_2O_3@Al-Si; Thermal insulation performance; Large temperature differences

Acknowledgment

This work was supported financially by the National Natural Science Foundation of China (No. 51776158) and the Foundation for Innovative Research Groups of the National Natural Science Foundation of China (No.51721004).