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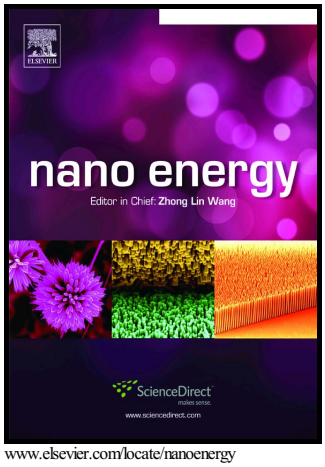

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Aerogel-based solar thermal receivers

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Abstract

In any solar thermal application, such as solar space heating, solar hot water for domestic or industrial use, concentrating solar power, or solar air conditioning, a solar receiver converts incident sunlight into heat. In order to be efficient, the receiver must ideally absorb the entire solar spectrum while losing relatively little heat. Currently, state-of-the-art receivers utilize a vacuum gap above an absorbing surface to minimize the convection losses, and selective surfaces to reduce radiative losses. Here we investigate a receiver design that utilizes aerogels to suppress radiation losses, boosting the efficiency of solar thermal conversion. We predict that receivers using aerogels could be more efficient than vacuum-gap receivers over a wide range of operating temperatures and optical concentrations. Aerogel-based receivers also make possible new geometries that cannot be achieved with vacuum-gap receivers.

Keywords: solar receiver; solar thermal; aerogel

1. Introduction

Solar energy is abundant; the solar flux reaching the earth's surface is orders of magnitude larger than humankind's global power consumption[1]. Harvesting this energy requires enormous areal coverage, since the solar flux is very dilute.

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