

其他

两级反射线性菲涅尔中高温集热系统热性能

吕明新^{1,2},宋固¹,董震¹,魏露露¹,赖艳华^{1*}

1.山东大学能源与动力工程学院,山东 济南 250061; 2.天津大学热能研究所,天津 300072

摘要:

针对复合抛物面集热器(compound parabolic collector, CPC)作为二级反射器和单层玻璃盖板的反射式线性菲涅尔中高温集热系统(linear Fresnel reflector concentrator, LFRC)的集热性能,基于稳态传热平衡原理,建立了集热系统稳态传热模型。系统地研究了风速、温度、太阳辐照度、聚光比、传热工质流速和流体进口温度等参数对接收器集热性能的影响,并给出了沿接收器管长的温度和能量分布情况。数值模拟结果表明:对于该集热系统,太阳辐照度、聚光比和工质进口温度是影响集热性能的关键影响因素,最高可达到72%,风速和环境温度对集热效率影响较小。因此增加接收器的长度能够很好地提高集热温度。

关键词: 太阳能 中高温集热 两级反射 传热模型 效率

Thermal behavior of two-stage linear Fresnel reflector concentrator

L Ming-xin^{1,2}, SONG Gu¹, DONG Zhen¹, WEI Lu-lu¹, LAI Yan-hua¹

1. School of Energy and Power Engineering, Shandong University, Jinan 250061, China;
2. Thermal Energy Research Institute, Tianjin University, Tianjin 300072, China

Abstract:

The thermal performance of linear Fresnel reflector concentrator(LFRC)with secondary compound parabolic collector (CPC) reflector and a single-layer glass cover were studied. A heat transfer model of LFRC system in steady state had been established according to energy balance principle. Based on this model, the influence of wind speed, environment temperature, solar radiation intensity, concentration ratio, working fluid speed and inlet temperature etc. on concentrator thermal performance had been analyzed systematically, and the temperature and energy distribution along the receiver tube were also given. The results showed that through the numerical simulation, the solar radiation intensity, concentration ratio and inlet temperature were recognized as the key factors affecting the thermal performance of this targeted of LFRC, which could reach 72%, while the environment factors such as wind and temperature had less influences. So it was helpful to increase the length of the receiver to improve the thermal performance.

Keywords: solar collector middle-high temperature two-stage reflection heat transfer model efficiency

收稿日期 2012-10-23 修回日期 网络版发布日期

DOI:

基金项目:

山东大学自主创新基金资助项目(2012ZD018); 济南市高校自主创新计划资助项目(201202090)

通讯作者: 赖艳华(1971-),女,山东烟台人,教授,博士,主要研究方向为能源利用与环境保护. E-mail: lai yh@sdu.edu.cn

作者简介: 吕明新(1970-),男,山东莱芜人,副教授,博士研究生,主要研究方向为能源利用和节能. E-mail: mingxinl@sdu.edu.cn

作者Email:

PDF Preview

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(2019KB)
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 太阳能
- ▶ 中高温集热
- ▶ 两级反射
- ▶ 传热模型
- ▶ 效率

本文作者相关文章

PubMed

参考文献:

1. 薛一冰 孟光 张乐.两种太阳能空气集热器性能比较研究[J]. 山东大学学报(工学版), 2009,39(6): 147-149
 2. 董少光,范广涵 .InGaN太阳能电池材料电学与光学性质的辐射研究[J]. 山东大学学报(工学版), 2008,38(4): 102-106
 3. 何云 苏新武 孙祝 徐永丽.太阳能烟囱内非稳态自然对流温度边界层分析[J]. 山东大学学报(工学版), 2009,39(6): 150-153
 4. 张乐文 邱道宏 程远方.井壁稳定的力化耦合模型研究[J]. 山东大学学报(工学版), 2009,39(3): 111-114
 5. 郭德栋^{1,2},沙爱民³.基于微波与磁铁耦合发热效应的融雪除冰技术[J]. 山东大学学报(工学版), 2012,42(4): 92-97
 6. 赖艳华¹,王庆为¹,吕明新¹,邵长波²,孔德旻¹.R404A / CO₂复叠式制冷系统的火用分析[J]. 山东大学学报(工学版), 2011,41(6): 115-121
-