

Performance analysis of an irreversible cascaded heat-transformer

Selahattin Göktun*, Ismail Deha Er

I.T.Ü Maritime Faculty, Department of Marine Engineering, 81716 Tuzla, Istanbul, Turkey

Received 30 November 2001; received in revised form 4 April 2002; accepted 7 April 2002

Abstract

By employing an irreversible thermodynamic approach the optimum performance of an cascaded absorption heat-transformer system is investigated. To get closer to real machines, the effects of thermal resistances and internal irreversibilities on the performance of the cascaded cycle is considered. An improved equation for the coefficient of performance (COP) of the system under consideration was obtained. The analyses show that the cascaded cycle has a significant increase in the systems gross temperature lift (GTL) over the single stage heat-transformer. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Cascaded; Heat transformer; Irreversible; Gross temperature lift

1. Introduction

Due to environmental pollution and continually rising conventional fuel prices, various novel apparati for saving energy are being experimentally investigated and produced. Single-stage absorption heat-transformers (SSAHTs) [1–6] are some of the most promising devices for upgrading industrial waste heat and heat from geothermal and solar sources to higher temperature levels. There are currently 15 SSAHTs operating in industrial plants worldwide [7–9]. SSAHTs are relatively simple, reliable and require little maintenance. However SSAHTs exhibit low coefficients of performance (COPs) and they have limited gross temperature lifts (GTLs) at values of about 50 °C [5]. Since SSAHTs exhibit continuous and stable operation under the part load conditions from 0 to 100%, a combination of them with each

* Corresponding author. Tel.: +90-216-353-7899; fax: +90-216-395-4500.

E-mail address: selogoktun@yahoo.com (S. Göktun).

Nomenclature

AHT	absorption heat-transformer
C	proportionality constant (dimensionless)
COP	coefficient of performance (dimensionless)
K_i	heat conductance ($i = 1, 2, \dots$) (WK^{-1})
M	sum of the heat conductances, $M = K_1 + K_2$, (WK^{-1})
P	thermal power output of the power sub-cycle of the first stage AHT in the cascade system (dimensionless)
p	thermal power output of the power sub-cycle of the first stage AHT in the cascade system (W)
Q	thermal power output of the power sub-cycle of the second stage AHT in the cascade system (dimensionless)
q	thermal power output of the power sub-cycle of the second stage AHT in the cascade system (W)
\dot{Q}	rate of heat transfer (W)
R_1	cycle-irreversibility parameter of the power sub-cycle of the first stage AHT in the cascade system (dimensionless)
R_2	cycle-irreversibility parameter of the heat pump sub-cycle of the first stage AHT in the cascade system (dimensionless)
R_3	cycle-irreversibility parameter of the power sub-cycle of the second stage AHT in the cascade system (dimensionless)
R_4	cycle-irreversibility parameter of the heat pump sub-cycle of the second stage AHT in the cascade system (dimensionless)
T	absolute temperature (K)
Z	sum of the heat conductances $Z = K_3 + K_4$, (WK^{-1})

Greeks (all dimensionless)

α	ratio of T_2 to T_1
β_1	COP of the heat pump sub-cycle of the first-stage AHT in the irreversible cascade system
β_{1r}	COP of the heat pump sub-cycle of the first-stage AHT in the reversible cascade system
β_2	COP of the refrigeration sub-cycle of the first-stage AHT in the irreversible cascade system
β_{2r}	COP of the refrigeration sub-cycle of the first-stage AHT in the reversible cascade system
β_3	COP of the heat pump sub-cycle of the second-stage AHT in the irreversible cascade system
β_{3r}	COP of the heat pump sub-cycle of the second-stage AHT in the reversible cascade system
β_4	COP of the refrigeration sub-cycle of the second-stage AHT in the irreversible cascade system

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات