Cairo University

THERMODYNAMIC OPTIMIZATION OF THERMAL ENERGY STORAGE SYSTEM COMPOSED OF CASCADED PHASE CHANGE MATERIALS

By

Eng. Mohamed Abd Elmenaem Mohamed Tayel

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Mechanical Power Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Approved by the
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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

Thermodynamic Optimization of Thermal Energy Storage System Composed of Cascaded Phase Change Materials

Key Words:
Thermal Energy Storage; Phase Change Materials; Waste Heat Recovery; Organic Rankine Cycle.

Summary:

In The present work, a proposed thermal storage system composed of cascaded phase change materials is optimized to be a part of waste heat recovery system. The thermal energy storage allows efficient use of waste heat to power organic rankine cycle to generate electrical power. Mathematical model was developed and coded in MATLAB software. The code is used to optimize the thermal and heat transfer parameter of the storage system. In addition, the code is used to carry out a parametric study. This optimization process took place to maximize the system second law efficiency by manipulating the melting points of the cascaded phase change materials. The study has also determined the effect of heat transfer fluid, organic rankine cycle working fluid inlet temperatures and number of heat transfer units' values in both charging and discharging directions on the system maximum second law efficiency.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date:

Signature:

Dedication

My sincere appreciation and gratitude to my family for their help and patience during the preparation of this work.

Especial thanks to my father who encouraged me to take the initial steps needed and exert required effort to accomplish this work, his soul was always beside me during all times I spent to complete and accomplish this research, GOD bless him.

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First and foremost, I thank **GOD**, the most gracious, the ever merciful for helping me finishing this work.

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