DEVELOPMENT OF CARBIDIC AUSTEMPERED DUCTILE IRON (CADI)

By
Hayam Abokhasha Ali

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
Metallurgical Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

Prof. Dr. Abdel-Hamid Ahmed Hussein

Professor of Metallurgy
Mining, Petroleum, and Metallurgical Department
Faculty of Engineering, Cairo University

Prof.Dr. Adel Abdel Moneim Saleh Nofal

Professor of Metal Casting
Foundry Technology Laboratory
Central Metallurgical R&D Institute (CMRDI)

Prof. Dr. Elsayed Mahmoud Elbanna

Professor of Metallurgy
Mining, Petroleum, and Metallurgical Department
Faculty of Engineering, Cairo University

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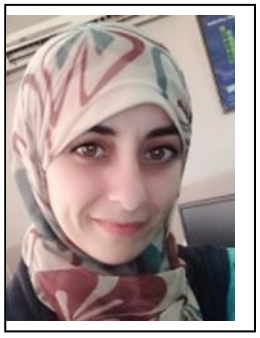
Approved by the
Examining Committee

Prof. Dr: Abdel-Hamid Hussein	Thesis Main Advisor
Prof.Dr: Adel Abdel Moneim Saleh Nofal Central Metallurgical R&D Institute (CMRDI)	Advisor
Prof.Dr: Elsayed Elbanna	Advisor
Prof. Dr: Mohamed Mamdouh Ibrahim	Internal Examiner
Prof. Dr: Mohamed Abdel Wahab Waly Central Metallurgical R&D Institute (CMRDI)	External Examiner

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2019

Engineer's Name: Hayam Abokhasha Ali
Date of Birth: 25/4/1979
Nationality: Egyptian
E-mail: hayam.abokhasha79@yahoo.com
Phone: 0103394510
Address: Cairo, El tebeen, El ruose 57.



Registration Date: 1/10/2014
Awarding Date: / /2019
Degree: Master of Science
Department: Mining, Petroleum and Metallurgical Engineering

Supervisors:

Prof. Abdel Hamid Ahmed Hussien
Prof. Adel Abdel Moneim Saleh Nofal
Central Metallurgical R&D Institute (CMRDI)
Prof. Elsayed Mahmoud El-Banna

Examiners:	Prof. Abdel Hamid Ahmed Hussien	(Thesis main advisor)
	Prof. Adel Abdel Moneim Nofal	(advisor)
	Central Metallurgical R&D Institute (CMRDI)	
	Prof. Elsayed Mahmoud El-Banna	(advisor)
	Prof. Mohamed Waly	(External examiner)
	Central Metallurgical R&D Institute (CMRDI)	
	Prof. Mohamed Mamdouh Ibrahim	(Internal examiner)

Title of Thesis:

Development of Carbidic Austempered Ductile Iron (CADI)

Key Words:

CADI; Impact toughness; Wear Resistance; Heat treatment; Austempering

Summary:
CADI is ductile iron containing carbides that is subsequently austempered to produce an ausferritic matrix with an engineered amount of carbides. The properties of this material are improved by alloying and also by varying the austempering heat treatment process parameters, and by dynamic and static condition. The presence of carbides is expected to promote an increase in the abrasion wear resistance, but on the other hand toughness is expected to decrease. Therefore, to maximize the performance of the CADI alloys to be used in a number of wear applications such as grinding balls, a good balance between abrasion resistance and toughness. To score this goal, four ways were achieved. The first one involved dynamic solidification, i.e. the introduction of mechanical vibration during solidification. The second involved alloying with Nb (1 %). The third was involved the combined action of Nb-alloying and dynamic solidification. Finally, heat treatment was carried out which included a two austempering temperature, in order to study the role of retained austenite during abrasion.

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: Hayam Abokhasha Ali Date:

Signature:

Dedication

Most importantly, none of this could have happened without my family. My husband Dr. Fawzy El Sayed who offered me unlimited devotion and encouragement through studying and everything. Every time I was close to uncompleted my graduate studies, he did not let me and I am, therefore, forever grateful. This dissertation stands as a testament to his unconditional love and support.

Acknowledgments

First and foremost, I have to thank my research supervisors, Professors Dr. Abdel Hamid Hussien, Dr. Adel Abdel Moneim Saleh Nofal and Dr. Elsayed Mahmoud Elbanna. Without their assistance and dedicated involvement in every step throughout the process, this thesis would have never been completed. I would like to thank them for their support and understanding over the past three years. I believe that I am lucky to be under supervision of this great committee.

My gratitude to my main supervisor, Prof. Dr. Abdel Hamid Hussien, whose teaching style and wide knowledge for different topics made a strong impression on me and I have always carried positive memories of his classes with me. He raised many interesting points in our discussion of early versions of this work and I hope that I have managed to address several of them here. Working with Prof. Dr. Abdel Hamid Hussien was an extraordinary experience in postgraduate level.

I am very grateful to Prof. Dr. Adel Abdel Moneim Saleh Nofal at the Central Metallurgical Research and Development Institute (CMRDI). Who provided me an opportunity to join their team as intern, and who gave access to the laboratory and research facilities. Without his precious support it would not be possible to conduct this research. His suggestions and discussions were very fruitful and he was very patient with my knowledge gap.

I would like to express my sincere gratitude to my supervisor Prof. Dr. Mohamed Abdel Wahab Waly at the Central Metallurgical Research and Development Institute (CMRDI) for the continuous support of my master study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in writing of this thesis. His course about solidification theory helped me greatly in explaining the material behavior during mechanical testes.

I must also thank two best friends at the Department of Metallurgy; Dr. Lamiaa Zaki, and Eng. Rania Mohamed for the continuous support of my master study and related research and giving me the chance to have this thesis rushed to the printer.

I would never forget the support of Eng. Rafaat Ahmed and My big sister Nadia Mohamed in machining specimens and measuring hardness, it is a great honor for me to work with them, for their efforts during the casting of my specimens and the staff of Foundry Technology Laboratory of CMRDI and particularly metallographic, melting, workshop staff for their sincere help.

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Nomenclature

CADI	Carbidic Austempered Ductile Iron
CDI	Carbidic Ductile Iron
DI	Ductile Iron
ADI	Austempered Ductile Iron
ARI	Abrasion Resistance Irons
SEM	Scanning Electron Microscopy
EDS	Energy Dispersive X-Ray Spectroscopy