

CURRICULUM VITAE

Dr. Thomas Ochuku Mbuya

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Engineering

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Academic Background

Doctor of Philosophy in Engineering Materials, University of Southampton, UK. Passed Defence in December 2011 & Awarded in June 2012.

My PhD work involved the evaluation of microstructure and fatigue performance of cast aluminium alloys for automotive piston applications. The work involved use of state of the art facilities such three dimensional microstructure evaluation using synchrotron X-ray Microtomography and advanced image analysis tools.

Master of Science in Mechanical Engineering (Industrial Engineering Option), University of Nairobi, 2003.

My M.Sc. degree focused on industrial engineering with emphasis on management principles. The program included the following courses (among others):

Production planning, scheduling and control
Maintenance management
Quality control and reliability
CAD/CAM
Works systems design and measurement
Engineering economics
Management information systems
Operations research

Bachelor of Science degree in Mechanical Engineering (First Class Honours), University of Nairobi, 1997

My undergraduate program included optional advanced courses in Production processes, fracture of materials and operations research.

KCSE at Cardinal Otunga High School, Mosoch, 1990

KCPE at Bogitaa Primary School, 1987

Work Experience

- Mar. 2007 to Date** Lecturer, Department of Mechanical and Manufacturing Engineering, University of Nairobi. I also carried out limited teaching duties at the University of Southampton during my PhD studies from November 2008 to December 2011. I resumed teaching at the University of Nairobi on 4th January 2012.
- Mar. 2004 to Mar. 2007** Assistant lecturer, Department of Mechanical and Manufacturing Engineering, University of Nairobi.
- 1998 to 2004** Graduate Assistant, Department of Mechanical Engineering, University of Nairobi.

Related Appointments

- March 2011 to July 2012** Editorial Assistant, Materials Science and Engineering A. This is one of the leading journals in the field of Materials Science and Engineering. (Published by Elsevier ltd.)

Research

My current research interest include the following:

1. Materials processing as well as evaluation of microstructure-mechanical property relationships of engineering materials for structural applications.
I have carried out considerable research on the control of casting variables for high quality production of castings. I have also carried out extensive research on the evaluation of processing conditions on the microstructure – mechanical property relationships of cast aluminium alloys. A significant portion of this research involved evaluation of efficient aluminium recycling aimed at developing recycle-friendly alloys appropriate for the local market. This work has been presented in various international conferences. One of our international presentations was acknowledged by conference participants and organizers as a significant contribution and awarded a certificate of excellence. Publications that have come out of this research are listed below and several others are in preparation.
2. University-industry technology transfer.
We are currently assessing the level of university-industry technology transfer in Kenya. The project involves assessing of technology innovations in Kenyan universities and evaluating the uptake of these innovations by industry,

- entrepreneurs or NGOs. The project aims to identify barriers and develop suitable policies as well as models for technology transfer.*
3. Industrial safety.
We are currently working on a project that aims to develop a key performance indicator system for manufacturing safety in paint manufacturing in Kenya.
 4. I am also currently coordinating the setting up of a consortium of researchers across Africa working in renewable energy subject areas such as materials for solar cells, wind energy and biofuels.
The aim of this consortium to build capacity in Africa through resource mobilization, appropriate technology research and training. The current target is to compete for a DFID funding amounting to 1.2 million sterling pounds.

Consultancy

I am a consultant in the areas of casting technology, materials processing issues in general, materials evaluation and testing, engineering failure analysis and general design of mechanical systems.

Publications

Peer reviewed journal papers since last promotion (9)

1. M. F. Oduori, T. O. Mbuya, J. Sakai, and E. Inoue, “Modelling of Crop Stem deflection in the Context of Combine Harvester Reel Design and Operation” *Agric Eng Int: CIGR Journal*, 14 (2) , 2012, 21–28.
2. M. F. Oduori, T. O. Mbuya, J. Sakai, and E. Inoue, “Kinematics of the Tined Combine Harvester Reel” *Agric Eng Int: CIGR Journal*, 14(3), 2012, 53–60.
3. T.O. Mbuya, I. Sinclair, A.J. Moffat and P.A.S. Reed, Micromechanisms of fatigue crack growth in cast aluminium piston alloys, *International Journal of Fatigue*, 42, 2012, 227-237.
4. T.O. Mbuya, I. Sinclair, A.J. Moffat and P.A.S. Reed, Analysis of fatigue crack initiation and S–N response of model cast aluminium piston alloys, *Materials Science and Engineering A*, 528 (24), 2011, 7331-7340.
5. T.O. Mbuya, B.O. Odera, S.P. Ng’ang’a and M.F. Oduori “Effective Recycling of Cast Aluminium Alloys for Small Foundries” *Journal of agriculture, science and technology* 12 (2), 2010, pp 162-181
6. B. R. Mose, S. M. Maranga and T. O. Mbuya, “Effect of Minor Elements on the Fluidity of Secondary LM25 and LM27-Type Cast Alloys” *AFS Transactions*, Vol 117, (2009), pp 93-101.
7. M.Oduori and T. Mbuya, “Wire Rope Selection for Manual Winch Application” *Journal of Engineering, Design and Technology*, Vol. 7 (2), (2009), pp. 207-222.
8. M. F. Oduori, T. O. Mbuya, J. Sakai and E. Inoue “Shattered Grain Loss Attributable to the Combine Harvester Reel: Model Formulation and Fitting to Field Data”. *Agricultural Engineering International: the CIGR Ejournal*. Manuscript PM 06 013. Vol. X. March, 2008.
9. T.O. Mbuya, B.O. Odera, S.P. Ng’ang’a and M.F. Oduori, “Effect of Some Casting

Parameters on the Microstructure and Mechanical Properties of Recycled Aluminium Castings of Various Automobile Components”, The Kenya Journal of Mechanical Engineering, vol.3, No. 1, 2007, pp. 29-43.

International conference presentations since last promotion (5)

10. T.O. Mbuya, I. Sinclair, K. Soady and P.A.S. Reed, Three-dimensional analysis of microstructure and casting defects in cast aluminium piston alloys, In Proceedings of the 13th International Conference on Aluminum Alloys (ICAA13), Carnegie Mellon University, Pittsburgh, Pennsylvania, June 3-7, 2012, pp. 55-60.
11. T.O. Mbuya, J. Crump, I. Sinclair, K. Soady, R. Thomson and P.A.S. Reed, Short fatigue crack growth micromechanisms in a cast aluminium piston alloys, In Proceedings of the 13th International Conference on Aluminum Alloys (ICAA13), Carnegie Mellon University, Pittsburgh, Pennsylvania, June 3-7, 2012, pp. 485-490.
12. T. O. Mbuya, B. R. Mose, S.P. Ng’ang’a and S. M. Maranga, “Improving the Mechanical Performance of a Secondary Cast Aluminium Piston Alloy through Addition of Minor Elements”, In Proceedings of the 12th International Conference on Aluminium Alloys, Yokohama, Japan, Sept. 5-9, 2010, pp. 2432-2437. ***Received Excellence award.***
13. T. O. Mbuya, I. Sinclair, B.R. Mose, S. M. Maranga and P.A.S Reed, “Characterisation of the Effect of Minor Elements on Microstructure Variations in a Secondary Cast Aluminium Piston Alloy”, In Proceedings of the 12th International Conference on Aluminium Alloys, Yokohama, Japan, Sept. 5-9, 2010, pp. 1279-1284.
14. T.O. Mbuya, I. Sinclair, A.J. Moffat, and P.A.S. Reed, “Effect of Hipping on the Microstructure and Fatigue Micromechanisms in Model Cast Aluminium Piston Alloys” Presented at the International Conference on Fatigue Damage of Structural Materials VIII, Hyannis Resort, Hyannis, MA, USA, 19-24th Sept. 2010. ***No proceedings.***

Local conference/Seminar presentations since last promotion (2)

15. T.O. Mbuya, I. Sinclair and P.A.S. Reed, “Micromechanisms of Long Fatigue Crack Growth in Hipped Cast Aluminium Piston Alloys”, The 16th PG conference, in Engineering Materials, Bio-engineering & Tribology, 1st October 2010, De Vere Hotel New Place, Southampton, UK.
16. T.O. Mbuya, A.J. Moffat, B.G. Mellor, I. Sinclair and P.A.S. Reed, “Effect of Hipping on the Fatigue Behaviour of a Cast Aluminium Piston Alloy”, The 15th PG conference, 2nd October 2009, Lyndhurst Park Hotel, Southampton, UK.

Drafted manuscripts

1. T.O. Mbuya, I. Sinclair and P.A.S. Reed, “On the effect of hipping on microstructure and porosity in a cast aluminium piston alloy: Three-dimensional X-ray microtomography analysis”, To be submitted to Scripta Materialia
2. T.O. Mbuya, I. Sinclair, R. Thomson and P.A.S. Reed, Short fatigue crack growth

micromechanisms in model cast Al-Si piston alloys, To be submitted to Materials Science and Engineering A

3. T.O. Mbuya, I. Sinclair, K. Soady and P.A.S. Reed, Three-dimensional analysis of microstructure and casting defects in model cast Al-Si piston alloys, To be submitted to Journal of Materials Science
4. T.O. Mbuya, I. Sinclair, K. Soady and P.A.S. Reed, 3D microstructure of model Al-Si piston alloys and its correlation to fatigue behaviour using extreme value statistics. To be submitted to Materials Science and Engineering A
5. T.O. Mbuya, I. Sinclair, and P.A.S. Reed, On the micromechanisms of fatigue failure in cast Al-Si alloys – A review. To be submitted to Materials Science and Technology

Manuscripts under preparation

1. T.O. Mbuya, I. Sinclair, and P.A.S. Reed, The microstructure and fatigue behaviour of Al-Si piston alloys – A review of recent developments. To be submitted to Journal of Metals
2. T.O. Mbuya, I. Sinclair, K. Soady and P.A.S. Reed, High temperature short fatigue crack growth behaviour in a model cast Al-Si piston alloy, To be submitted to Materials Science and Engineering A

Current research activities

1. The effect of high pressure torsion (HPT) of the microstructure and mechanical properties of Al-Si piston alloys.

This is in collaboration with Prof. Philippa Reed, Dr. Nong Gao and Mr. C.T. Wang (PhD student) of the University of Southampton, UK. One Msc student is working on the project.

2. Microstructure and fatigue behaviour of recycled piston alloys.

This is in collaboration with Prof. Philippa Reed (University of Southampton) and Dr Bruno Mose (JKUAT). One Msc student is working on the project.

3. Development of recycle-friendly cast aluminium alloys for automotive and structural applications. Funded up to Kshs 1.85 m for 3 years

This is in collaboration with Prof. Philippa Reed (UoS). One Msc student is working on the project but also looking for a PhD student. We have also been approached for partnership with industry by an aluminium recycler.

4. Development of key performance indicator (KPI) system for manufacturing safety in paint manufacturing firms in Kenya

An Msc student is working on this project.

5. Assessment of university-industry technology transfer in Kenya.

A PhD student has just started working on this project.

6. Modeling, simulation and experimental validation of microstructure and microporosity formation during solidification of aluminium alloys.

A PhD student has just started working on this project which is partially funded by AMSEN.

Peer reviewed journal papers before last promotion (4)

1. T.O. Mbuya, M. F. Oduori, G. O. Rading, and M. S. Wekesa “Effect of runner design on the mechanical properties of permanent mould aluminum castings.” International Journal of Cast Metals Research, vol. 19, No. 6, 2006, pp. 357-360.
2. T.O. Mbuya, “Element effects on the fluidity of cast Al-Si alloys” AFS Transactions, vol. 114, 2006, pp. 163-180.
3. M.F. Oduori and T.O. Mbuya, “The limiting value of the fleet angle of a rope running off a sheave”, The Kenya Journal of Mechanical Engineering, Vol. 1, No. 1, 2005, pp. 37-46.
4. T.O. Mbuya, B.O. Odera and S.P. Ng’ang’a, “Influence of iron on castability and properties of aluminium silicon alloys: literature review”, International Journal of Cast Metals Research, Vol. 16, No. 5, 2003, pp. 451-465.

Local conference/Seminar presentations before last promotion (3)

1. T.O. Mbuya, B.O. Odera, S.P. Ng’ang’a and M.F. Oduori, “Effect of Some Casting Parameters on Microstructure and Mechanical Properties of Two Recycled Aluminum Foundry Alloys” Presented in a Seminar at Jomo Kenyatta University of Agriculture and Technology in October 2006.
2. M.F. Oduori, D.M. Munyasi, and T.O. Mbuya, “Case for Agricultural Mechanization and a Homegrown Agricultural Machinery Industry in Kenya.” Peer Reviewed and presented during the 10th KARI Biennial Scientific Conference and Agricultural Forum, 12-17th Nov., 2006 at KARI Headquarters Complex, Loresho, Nairobi. ***Peer reviewed local seminar***
3. F.M. Oduori and T.O. Mbuya, “Derivation of the expression for the upper limiting value of the fleet angle of a rope running off a sheave”, Proceedings of the 6th Mechanical Engineering Annual Seminar, Jomo Kenyatta University of Agriculture and Technology, June, 2000

Review Engagements

I am a reviewer in the following Materials Science and Engineering journals:

1. Materials Science and Engineering A

2. Materials Letters
3. International Journal of Fatigue
4. The Kenya Journal of Mechanical Engineering

Post-graduate Supervision

Completed supervision (1 MSc student)

1. R. B. Mose, "Effect of Minor Elements on Castability, Microstructure and Mechanical Properties of Recycled Aluminium Alloys", MSc. Thesis, Dept. of Mechanical Engineering, Jomo Kenyatta University of Agriculture & Technology, 2009.

Active supervision (2 PhD and 4 MSc students)

1. N. WaKarani, Modeling, simulation and experimental validation of microstructure and microporosity formation during solidification of aluminium alloys. PhD, UoN, AMSEN funding. Expected to be completed in 3 years.
2. J.K.N. Kamanda, Assessment of university-industry technology transfer in Kenya. PhD, UoN. Expected to be completed in 3 years.
3. F.M. Madaraka, The effect of high pressure torsion (HPT) of the microstructure and mechanical properties of Al-Si piston alloys, MSc, JKUAT. To be completed by December 2013.
4. J.O., Obiko, Microstructure and fatigue behaviour of recycled piston alloys, MSc, JKUAT. To be completed by December 2013.
5. G.T. Zeru, Development of recycle-friendly cast aluminium alloys for automotive and structural applications, MSc, JKUAT. To be completed by December 2013.
6. E. Musyoka, Development of key performance indicator (KPI) system for manufacturing safety in paint manufacturing firms in Kenya, MSc, JKUAT. To be completed by December 2013.

Graduate Thesis Examination

I have examined the following graduate thesis reports:

1. Niva, A.E., "Microstructural Evolution and Fatigue Crack Growth Characteristics through the HAZ of Welded AA6061", MSc. Thesis, Dept. of Mechanical and Manufacturing Engineering, University of Nairobi, 2012.
2. Koech, P.K., "A Study on the Effects of Iron on Microstructure and Mechanical Properties of Aluminium-Silicon Alloys", MSc. Thesis, Dept. of Mechanical and Manufacturing Engineering, University of Nairobi, 2012.

Personal Details

Date of birth 1st December, 1972
Nationality Kenyan

Referees

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