Selection of wear-resistant materials and implementation framework for remanufacturing ground exploring tools (GETs) for coal mining applications: case-study of continuous miner cutter (CMC's) components

Review Published: 10 April 2025

Volume 15, pages 207–271, (2025) Cite this article

Journal of Remanufacturing

Aims and scope

Submit manuscript

I. B. Akintunde, E. E. Lindsay, Eyitayo O. Olakanmi, R. V. S. Prasad, B. I. Matshediso, T. Motimedi, A. Botes & S. L. Pityana

Abstract

Ground exploring tools (GETs), used in coal mining industries, encounter severe failure due to their continuous pressing and scratching against the coal seam embedded with hard bands and impurities. Failure of GETs lead to direct cost expenditure due to replacement of worn-out components; besides, significant indirect cost resulting from machine downtime when they are removed, and new ones are reinstalled. Mining businesses replace worn GETs with new parts at an exorbitant cost at a great risk to their

sustainability. Replacement goes against the ethos of the circular economy (CE) philosophy which aims at ensuring highest value of resource utilisation while eliminating waste by improving the design of materials, products, and systems. A critical analysis of the approaches of CE for restoring damaged GETs reveals remanufacturing is the best option to adopt to keep GETs in good working conditions. Meanwhile, there is scanty literature to guide remanufacturing practitioners on materials selection and framework for implementing remanufacturing of damaged GETs. This review addresses this challenge by identifying appropriate wear-resistant materials and the most economically feasible remanufacturing technology which restores the performance of GET's components to at least as new upon remanufacturing. Using the components of continuous miner (CM) as a case study, the operating environments in which GETs function are described to gain insight into the modes of failure encountered. Information gathered from the operation environments of the GETs and their failure modes assisted in selecting appropriate wear-resistant materials. Techno-economic analysis of the remanufacturing of various modes of failure of the components of GETs was carried out to ascertain the economic feasibility of remanufacturing various failure modes. Future perspectives of failure analysis, material selection, and framework for implementing remanufacturing of various failure modes (based on severity of damage) in GETs are presented. This review extends the frontier of knowledge in the fields of GETs remanufacturing and potential wear-resistant materials for GETs to academic researchers and industrial practitioners.

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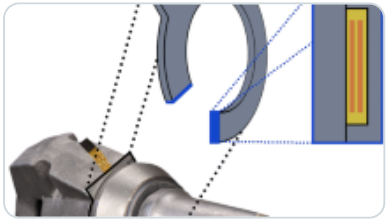

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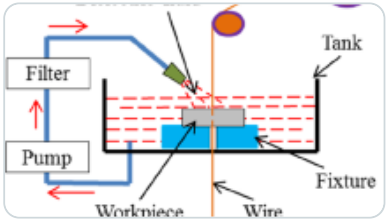

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Data Availability

No datasets were generated or analysed during the current study.

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Acknowledgements

NA

Funding

The article is a product of Education for Laser-based Manufacturing (ELbM) Scholarship research project with Agreement No. 2019–1973/5 and Project No. 614655, funded by European Commission 'Education, Audiovisual and Culture Executive Agency' (EACEA). Furthermore, research grant No. HLHA23X task ALC-R016 offered by the African Laser Centre (ALC), South Africa, and Postgraduate research grant award (DVC/RDI/2/1/7 V (149); Code: S00390 and DVC/RDI/2/1/7 V (143)) presented by Botswana International University of Science and Technology (BIUST).

Author information

Authors and Affiliations

Department of Mechanical Energy & Industrial Engineering, Botswana International University of Science & Technology, Palapye, Botswana

I. B. Akintunde, E. E. Lindsay & Eyitayo O. Olakanmi

UNESCO Chair On Sustainable Manufacturing & Innovation Technologies (UCoSMIT) Team, Botswana International University of Science & Technology, Palapye, Botswana
I. B. Akintunde, E. E. Lindsay, Eyitayo O. Olakanmi, R. V. S. Prasad & B. I. Matshediso

Advanced Manufacturing & Engineering Education (AMEE) Research Group, Botswana International University of Science & Technology, Palapye, Botswana
I. B. Akintunde, E. E. Lindsay, Eyitayo O. Olakanmi & R. V. S. Prasad

Department of Chemical, Materials & Metallurgical Engineering, Botswana International University of Science & Technology, Palapye, Botswana
R. V. S. Prasad

Department of Mining & Geological Engineering, Botswana International University of Science & Technology, Palapye, Botswana
B. I. Matshediso

Centre for Mining & Mineral Beneficiation, Botswana International University of Science & Technology, Palapye, Botswana
B. I. Matshediso

Morupule Coal Mines, Palapye, Botswana
T. Motimedi

Materials & Metallurgical Engineering Department, Federal University of Technology Minna, Minna, Nigeria
I. B. Akintunde

Department of Mechanical Engineering, Nelson Mandela University, Port-Elizabeth, South Africa
A. Botes

Laser-Enabled Manufacturing Research Group, Council for Scientific & Industrial Research, Pretoria, South Africa
S. L. Pityana

Contributions

Authorship contributions statement Idris Babatunde Akintunde: Conceptualization of the work, drafted the work & revised the intellectual content. Emmanuel Efemena Lindsay: Conceptualization of the work, drafted the work & revised the intellectual content.

Eyitayo Olatunde Olakanmi: Funding acquisition, Supervision, Conceptualization of the work, Revised the intellectual content, approved the version to be published; and agree to be accountable for all aspects of the work. Raghupatruni, Prasad Ventaka Satya: Revised the intellectual content, approved the version to be published. Bonny Matshediso: Conceptualization of the work. T. Motimedi: Conceptualization of the work. Botes Annelize: Supervision, Conceptualization of the work, Revised the intellectual content, approved the version to be published. Sisa Lesley Pityana: Supervision, Conceptualization of the work, Revised the intellectual content, approved the version to be published.

Corresponding author

Correspondence to Eyitayo O. Olakanmi.

Ethics declarations

Competing interests

The authors declare no competing interests.

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Cite this article

Akintunde, I.B., Lindsay, E.E., Olakanmi, E.O. *et al.* Selection of wear-resistant materials and implementation framework for remanufacturing ground exploring tools (GETs) for coal mining applications: case-study of continuous miner cutter (CMC's) components. *Jnl Remanufactur* **15**, 207–271 (2025). https://doi.org/10.1007/s13243-025-00148-9

Received	Accepted	Published
09 September 2024	08 January 2025	10 April 2025

Version of record	Issue date
10 April 2025	November 2025

DOI
https://doi.org/10.1007/s13243-025-00148-9

Keywords

Ground exploring tools (GETs) Remanufacturing Wear-resistant material

Process development Mechanical properties Microstructure