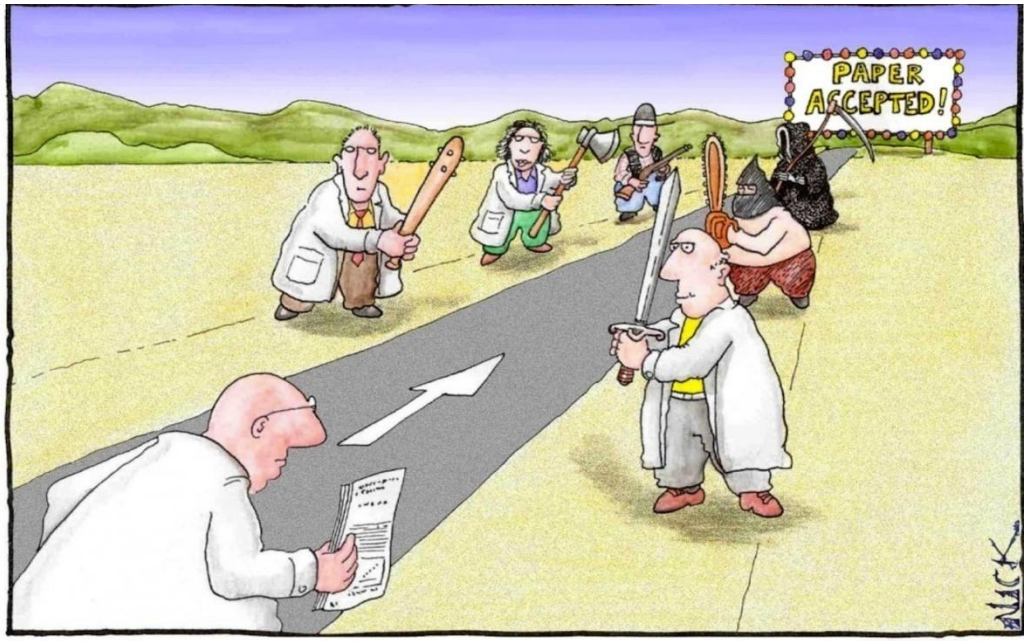
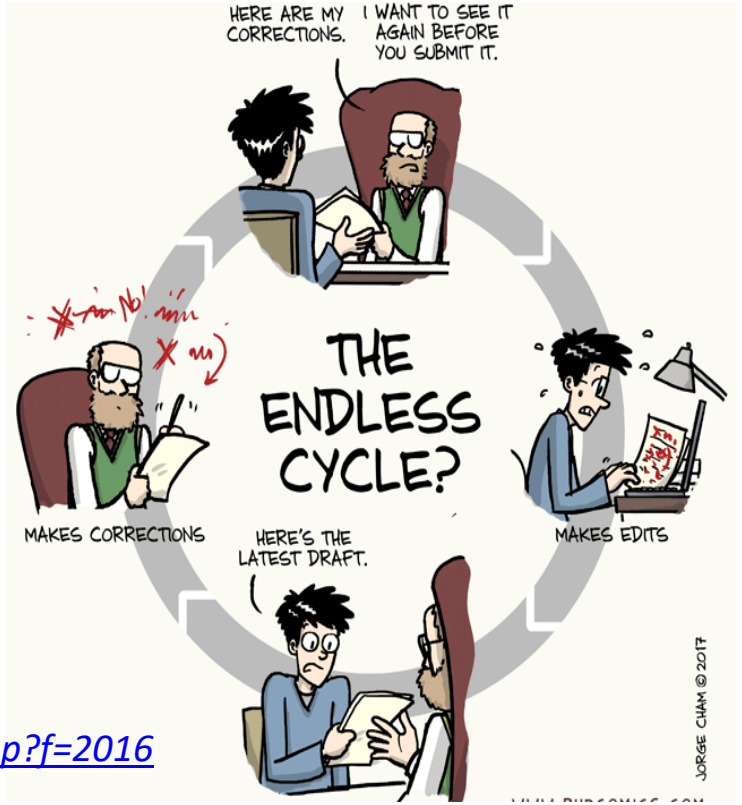
CHAPTER 6

Research Communication (Reporting Research Findings)

Contents

1. Introduction to Reporting Research Findings





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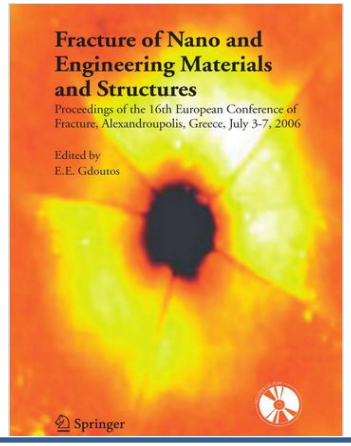
Examples



FATIGUE CRACK LENGTH MEASUREMENT METHOD WITH AN ION SPUTTERED FILM

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Journal of Advanced Mechanical Design, Systems, and Manufacturing
Vol. 3, No. 1, 2009

Softening Behavior of Hardness and Surface Fatigue of Rolling-Sliding Contact in the Case of Developed Alloy Steels*

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AIMS Materials Science, 2019, 6(6): 985-996. doi: 10.3934/matersci.2019.6.985.
Research article

Mechanical properties of sisal-epoxy composites as functions of fiber-to-epoxy ratio

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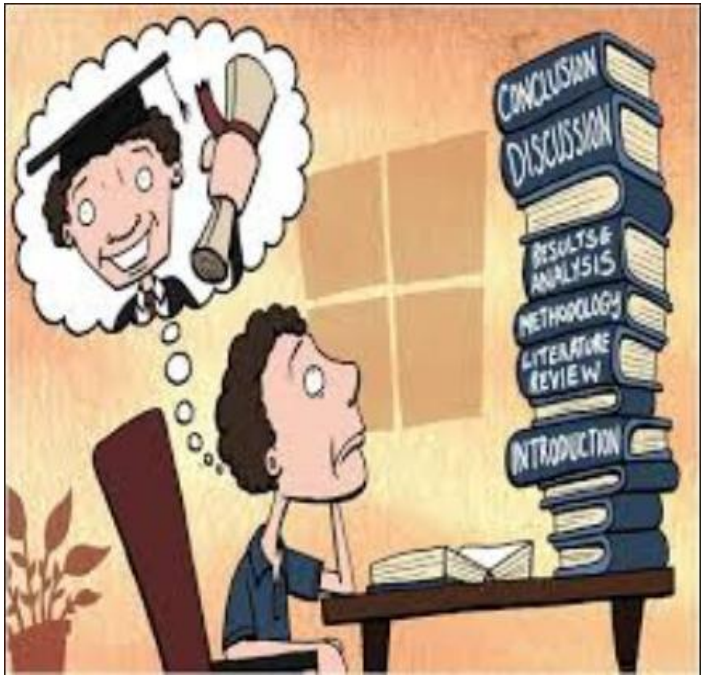
Received: 09 July 2019 , Accepted: 26 September 2019 , Published: 22 October 2019

2. Writing a Scientific Report

- Scientific paper, technical report, assignment report, abstract….
- Exposed to the reader and the communication is in indirect way
- Good writing?
  - Knowing the purpose of writing …
  - Knowing the target audience
    - Postgraduate students should focus
      - » Advisors
      - » Graduate examining committee
      - » Current and future researchers
      - » Funding agencies
  - Organization of the paper



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– Organization of the paper

- The sequence in which the researcher presents each type of information
- Structure for typical scientific report
  - Title
  - Acknowledgement
  - Abstract
  - Introduction
  - Materials, Methods and Conditions
  - Results and discussion
  - Conclusion
  - References
  - Appendices, where applicable

-concise

-accurately reflect the content of the paper

-Abbreviations usually should not appear

-Whom do you acknowledge?

---professionally contributed to the work

a) Purpose
b) Materials, method and condition
c) Results
d) Principal conclusion
- Application

Journal

Title

Vol. 3, No. 1, 2009

Softening Behavior of Hardness and Surface Fatigue of Rolling-Sliding Contact in the Case of Developed Alloy Steels*

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Authors

Abstract

Abstract

To get high performance, downsizing and weight saving of the power transmission systems, the improvement of machine elements has been required. In this study, case-carburized gear materials for a high load-carrying capacity were developed. Low-alloyed steels with 1%Cr-0.2%Mo, 1%Cr-0.2%Mo-1%Si and 1%Cr-0.2%Mo-2%Ni (Cr-Mo steel, Cr-Mo-Si steel and Cr-Mo-Ni steel) were melted in a hypoxia vacuum. Test rollers were made of the developed steels, and they were carburized (Type A and Type B), hardened and tempered. Heating retention tests were carried out to investigate the softening behavior of hardness at high heating temperatures in the case of the developed steels. Roller tests were conducted under the rolling-sliding contact and high-load conditions to study the surface fatigue of the developed steels. From the obtained test results, it was found that the softening behavior of surface hardness at high temperatures in the cases of Cr-Mo-Si steel (Type A) and Cr-Mo-Ni steel (Type B) is lower than that in the cases of Cr-Mo steel (Type A) and Cr-Mo steel (Type B). In the cases of Cr-Mo-Si steel (A) and Cr-Mo-Ni steel (B), micro- and small-pitting area ratios are smaller and large-pitting life is longer than those in the cases of Cr-Mo steel(A) and Cr-Mo steel(B) under the same carburizing treatment method and high-load conditions. Furthermore, the relationship between the softening behavior of surface hardness on the heating pattern and the surface fatigue on the rolling-sliding contact of the developed alloy steels was clarified.

Key words: Gear, Roller, Material, Alloy Steel, Carburizing, Hardness, Temperature, Surface Fatigue

Acknowledgement

Acknowledgements

The authors would like to thank Sumitomo Metal Industries, Ltd., and Nippon Oil Corporation for supplying the test materials and lubricants for this experiment. They also express their thanks to the staffs of the Department of Mechanical Systems Engineeri the Frontier Science Research Center (University of Miyazaki) for their ass study.

- Structure for typical scientific report (Cont'd)
  - Title
  - Acknowledgement
  - Abstract
  - Introduction
  - Materials, Methods and Conditions
  - Results and discussion
  - Conclusion
  - References
  - Appendices, where applicable

-provide sufficient background information

-addresses nature and scope of the problem

-aims of the research

-How and with what means the project is accomplished

-How the data is analyzed

-Detail information is required

- Core section with tables, figures, charts
- What is obtained from the experiment conducted
- Clear and arranged in logical order

Results

Table 1 Experimental conditions and results of roller tests

Test No.	Material (Carburizing type)	Normal load F kN (Max. Hertzian stress σ_H GPa)	No. of cycles N_2 (*1)	Max. surface temperature during running T K (*1)	Surface fatigue after running (*1)		
					No. of micro-pits ($0.01 \leqq d < 0.1$)	No. of small-pits ($0.1 \leqq d < 0.3$)	No. of large-pits ($0.3 \leqq d$)
					Area S_S (*4)	Area S_M (*5)	
RT-01	① Cr-Mo steel (A)	5.7 (1.2)	1.0×10^7	397	144	0	0
RT-02	② Cr-Mo steel (B)			389	119	4	0
RT-03	③ Cr-Mo-Si steel (A)			388	165	0	0
RT-04	④ Cr-Mo-Ni steel (B)			393	236	0	0
RT-05	① Cr-Mo steel (A)	10.2 (1.6)		430	27	2	0
RT-06	② Cr-Mo steel (B)			428	158	5	0
RT-07	③ Cr-Mo-Si steel (A)			431	24	2	0
RT-08	④ Cr-Mo-Ni steel (B)			438	235	2	0
RT-09	① Cr-Mo steel (A)	15.9 (2.0)		469	52	5	0
RT-10	② Cr-Mo steel (B)		0.1×10^7 (*3)	467	0	0	0
RT-11	③ Cr-Mo-Si steel (A)		1.0×10^7	469	56	16	0
RT-12	④ Cr-Mo-Ni steel (B)			471	170	12	0
RT-13	① Cr-Mo steel (A)	26.9 (2.5)	0.2×10^7 (*2)	524	19	4	2 (80) (*6)
RT-14	② Cr-Mo steel (B)		0.4×10^7 (*2)	528	64	21	1 (22) (*6)
RT-15	③ Cr-Mo-Si steel (A)		0.3×10^7 (*3)	512	14	6	0
RT-16	④ Cr-Mo-Ni steel (B)		0.7×10^7 (*2)	539	38	5	1 (2318) (*6)

ler, (*2) : Large-pits formed, (*3) : Troubles occurred, (*4) : Measured area by SEM (2.19×1.81 mm^2), by stereoscopic microscopy (8.5×219.8 mm^2), (*6) : Area of pits (mm^2)

6. Conclusion

In this study, the high-strength case-carburized gear materials for a high load-carrying capacity were developed. The developed alloy steels were melted in a hypoxia vacuum. Test rollers were made of developed alloy steels, and they were carburized, hardened and tempered. By using a heating retention test apparatus, heating retention tests were carried out to investigate the softening behavior of hardness in the case of case-carburized steels. Under high-load conditions, roller tests were performed using a two-roller contact fatigue testing machine to study the surface fatigue of the developed steels. In the cases of Cr-Mo-Si steel (A) and Cr-Mo-Ni steel (B), the following results were obtained and compared with those of Cr-Mo steel (A) and Cr-Mo steel (B).

(1) The softening behavior of surface hardness is lower.

(2) The changes in estimated surface hardness are smaller at elevated temperatures.

(3) Micro- and small-pitting area ratios are smaller.

(4) Large-pitting life under high-load conditions is longer.

Therefore, the increase in the amount of alloying elements (silicon and nickel) of case-carburized steels improves the mechanical properties at high temperatures and the surface durability of the rolling-sliding contact.

Furthermore, the relationship between the softening behavior of surface hardnes heating pattern and the surface fatigue on the rolling-sliding contact of the developed al steels was clarified. The developed steel with low softening behaviors of surface hardness at high temperatures becomes superior in the surface durability of the rolling-sliding contact, even if the initial surface hardness of the developed steels is equal. Therefore, it is not possible to estimate the large-pitting life of the developed steels on the basis of the initial surface hardness.

Conclusion

References

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(2) Nakanishi T. and Ariura Y., Effect of Surface-Finishing on Surface Durability of Surface-Hardened Gears, *Proceedings of the International Conference on Motion and Power Transmissions, Hiroshima, Japan* (1991), pp. 828-833.

(3) Nakanishi T., Takeuchi T. and Deng G., Relation between Surface Temperature and Surface Damage in Rolling-Sliding Contact of the Case-Carburized Alloy Steel, *Proceedings of the JSME International Conference on Motion and Power Transmissions (MPT2001) , Fukuoka, Japan*, Vol. I (2001), pp. 255-260.

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Exercises 6-1

- Evaluate the Abstracts of the two articles and write your comment based on their strong points and limitations

3. Presenting Research Findings

3.1 Oral presentation

- Preparing an oral presentation (the slide.----
- Organization
- Delivering an oral presentation (the talk)
- Questions and answers
- Attending other oral presentations

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3.2 Research seminar

- Presentations of original research conducted by the presenter or partners
- MSc thesis presentation is a research seminar

3.3 Course seminar

- The primary function is to review recent progress on a particular topic
- Creates an understanding of the topic for the reader

4. Written and Verbal Presentation

- Written and verbal presentation (Poster)
  - A kind of combination of written and verbal presentation
  - Attention :-
    - Selecting content,
    - designing poster
    - presenting effectively

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Exercises 6-2

- As a postgraduate student, what do you benefit if you attend MSc thesis defense or research seminar in your field of specializations?

Thank You !