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SCIENTIFIC REPORT

Specifications

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Summary and Next Steps for Author/s



Message from the Top Impact Editing team

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Thank you for choosing Enago to assist you in peer reviewing and editing of the manuscript to publish in top-ranking journals. We have assessed the appropriateness of study design, relevance of methodology, and significance of your findings to attract the reader's attention. We have also ensured the clarity and flow of content, and structured and formatted it according to your target journal. We have prepared this customized report that gives you a scientific as well as language assessment status of your paper, along with a list of improvement areas addressed by us. We have suggested revisions to minimize chances of journal rejection. Please read this report along with the comments in the revised manuscript and respond to them. You are also requested to confirm if the revisions clearly present your study and are appropriate to the best of your knowledge.



Assignment details	
Assignment Code	XACDB-2
Manuscript Title	Effect of Aging on the Strength of Corrosion Resistant Incoloy Alloys 945 and 945X: A Microstructural Perspective
Total word count	2622
Article Type	Original Research Article
Journal name and URL	Materials Science and Engineering: A; https://www.journals.elsevier.com/materials-science-and-engineering-a

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RESEARCH STRENGTH

○ SUMMARY

This article is focused towards an in depth microstructural study conducted on nickel based super alloys, Incoloy 945 and 945x. The authors have utilized sophisticated characterization tools such as transmission electron microscopy, scanning electron microscopy etc., to quantitatively examine the phases present in the microstructure of the samples subjected to various ageing and heat treatments. The microstructural observations obtained experimentally are compared with simulation studies. This article is a first report of characterization of microstructure and mechanical properties of these alloys in comparison to other nickel-based alloys.

○ ORIGINALITY AND SIGNIFICANCE OF RESEARCH [Rating: Excellent, Good, Fair, or Poor]

Excellent

The study is novel and it can have multiple applications in the field of Material Science and Engineering. Incoloy alloys are critical for numerous structural applications. Hence, the understanding of the microstructural features of these alloys when subjected to various ageing and heat treatments is very critical to the fields of physical metallurgy, mechanical metallurgy and structural applications of materials. In this regard, the current manuscript is of very high significance as it focuses in comparing the microstructure of the alloys with their mechanical strength.

- The research content is acceptable as it provides a comparative report about microstructural observations obtained experimentally with simulation studies. However, the structure property correlation studies presented in the article is inadequate. There is further scope to corroborate the results obtained from the mechanical studies with the microstructural evidences. The study is very relevant to the field of material science and engineering wherein scientists can use it for fabrication of down-hole and surface well equipment including tubular products, valves, hangers, landing, nipples, tool joints and packers.

CONTENT REVIEW

○ TITLE, ABSTRACT, AND KEYWORDS

The title adequately reflects the theme of the paper and highlights the core research initiative. The article studies the effects of aging and heat treatments on the mechanical properties of Incoloy alloys. Since microstructural evidences are predominantly used for evaluating the properties of the alloy, the title could be modified to "Effect of Ageing on the Strength of Corrosion Resistant Incoloy Alloys 945 and 945x: A Microstructural Perspective". We have revised the title in the manuscript.

- Add the following details:

1. Author names and affiliations
2. Corresponding author name and complete address – including telephone number, e-mail address, and postal code of the institution.

The abstract does clarify the purpose and significance of the study. The structure of the abstract is clearly presented. The abstract provides a brief overview of the purpose of study, materials used and results. The language adapted in the abstract is simple and understandable. A brief introduction about the phases discussed in the section, namely, γ' and γ'' , would help in conveying the essence of the study in a clear and well-defined manner. There are instances of abbreviations which are unnecessarily defined in the abstract section (for example, STEM). Such definitions should be avoided to enhance the readability of the section. Space should be provided between the numeric quantities and their units.



Detailed comments have been added in the manuscript file. The author should address all mentioned issues accordingly.

○ INTRODUCTION AND LITERATURE REVIEW

The introduction section is elaborate and provides a detailed report on the background and significance of the current study. The importance of the various elements and phases in the alloy are clearly described. The sequence of statements in the introduction section coherently leads to the intended objective of the study.

The language of the article needed revisions, which we have now addressed in the edited manuscript. We have also made the article more concise to avoid unnecessary lengthy discussions. There were few vital details that have not been addressed. An abbreviation for face centered cubic has been defined but has been seldom used in the manuscript. While defining the composition of the γ' phase, (Ni₃Al, Ti, Nb) should be replaced with Ni₃(Al, Ti, Nb). The authors have used Hume-Rothery rules as a reference to infer the stability of Ni₃Al phase as compared to Ni₃Ti, Ni₃Nb and Ni₃Ta owing to the similarity in atomic radius of Al to Ni than the other mentioned elements. In this regard, it is more appropriate to substitute reference 9 with journal article which present the Hume Rothery rules, namely -

W. Hume-Rothery, G. W. Mabbott, and K. M. Channel-Evans, "The freezing points, melting points, and solid solubility limits of the alloys of silver and copper with the elements of the B Sub-Groups", Philos. Trans. R. Soc. London, Ser. A. 233, 1934, 1-97.

The above modification has been addressed in the 'Introduction' section of the manuscript. The author is advised to read the sentence and confirm if it is in line with his research focus.

The articles (1) P. W. Reynolds and W. Hume-Rothery, "The constitution of silver-rich antimony-silver alloys", J. Inst. Metals. 60, 1937, 365-374, and (2) W. Hume-Rothery, "Factors affecting the stability of metallic phases", In: P. S. Rudman, J. Stringer and R. I. Jaffee, eds. Phase Stability in Metals and Alloys. New York: McGraw-Hill, 1967. pp. 3-23 are highly related articles to the manuscript that were added by the author. This has enhanced the knowledge and background about alloy constituents and their extent of stability while relating them to the initiative of similar analysis in the paper.

The limits and the future prospectus of the study are also not discussed. The author should refer to the detailed comments for sections applicable and revise.

○ METHODS AND STATISTICAL ANALYSIS

The experimental section explains in detail the material used, the heat and aging treatments conducted, the properties evaluated, the microstructural characterization techniques employed and the sample preparation methods adopted for various microstructural evaluation in the manuscript.

The readability of the experimental section would be improved if it is organized into sub-sections titled heat treatments, mechanical studies and microstructural studies. These changes have been incorporated in the edited manuscript by segregating the sections under headings – Experimental materials, Heat treatments, etc.

In the current state, the methods describing mechanical properties, evaluation, and microstructural studies are not grouped sufficiently which affects the readability of the section. We have edited the "Experimental Methods" section to enhance the research flow and readability.

- The choice of methods used is not explained properly. Many similar studies have been performed in the past. The novelty of the use of HPLC/HNMR/recombination has not been highlighted.
- The methods used have been explained in depth in order to be replicated by other users. Many important details regarding the protocols have been clearly explained.
- Additional information such as load versus displacement plot corresponding to the tensile test has also been included for all the alloys showing the elastic limit, yield strength and ultimate tensile strength. This has added to the experimental methods implemented by the authors to achieve the objectives of the study.



- The author has not mentioned anything about the many shortcomings in the procedures and the research rationale. This needs to be addressed in the manuscript.

There are no details about the statistical tools applied to obtain the analyses in this study. It is recommended that the author performs statistical analysis of data using ANNOVA and calculate difference between treatment groups using multiple t-test.

○ RESULTS AND DISCUSSION

The results adequately address the stated research objectives and are supported by the tables and figures. The interpretations arise logically from the reported data and are also supported by the references cited in the text. There are several instances of the content being repeated which not only affects readability but also makes the article lengthy. This section has been edited for better clarity of results obtained.

No statistical analyses are performed and significance values are all missing for the hardness values, γ' size, and such other data obtained for the variables.

The results and discussion section is well-defined since the primary objective of the study is stated with the help of the figures, tables and supporting data. However, according to the journal instructions, these two sections should be presented as different sections.

Currently, this section extensively examines the microstructures of samples subjected to various heat and aging treatments and provides a correlation with their mechanical properties. In section 3.3, the microstructures corresponding to AR, STA and ST samples of both the alloys are compared. However, it merely describes the microstructural features observed from the micrograph without providing sufficient inference to the observations. The limitations of the study have not been highlighted. The significance of the findings in light of the past studies and present novelty has not been addressed. Relevant references could be cited.

Detailed similar comments have been added in the manuscript file. The author should address all mentioned issues.

○ FIGURES AND TABLES

The figures are self-explanatory and aid in easy interpretation of the results. The figure captions, axis variables and units are accurate. All the figures are cited in the text. The font size of the length scales of figure 1 should be increased to enable better readability. The figure captions are very lengthy and should be replaced with concise captions.

The tables facilitate a clear understanding of the study and they present the results in a concise manner. The tables are cited in the text. The results included in the tables should not be repeated in the text.

○ CONCLUSION

The conclusion section is based on the results and is logically stated. It is backed by sufficient evidence and clearly justifies the obtained results. However, future prospectus of the study needs to be detailed.

○ REFERENCES

The references are appropriate and are cited as and when required throughout the manuscript. However, citing more articles from scientific journals would strengthen the manuscript content. A consistent citation structure in the reference section should be maintained while citing the articles from journals and books.

Following are some suggestions to use:

(1) W. Hume-Rothery, G. W. Mabbott, and K. M. Channel-Evans, "The freezing points, melting points, and solid solubility limits of the alloys of silver and copper with the elements of the B Sub-Groups", Philos. Trans. R. Soc. London, Ser. A. 233, 1934, 1-97



- (2) P. W. Reynolds and W. Hume-Rothery, "The constitution of silver-rich antimony-silver alloys", J. Inst. Metals. 60, 1937, 365-374
- (3) W. Hume-Rothery, "Factors affecting the stability of metallic phases", In: P. S. Rudman, J. Stringer and R. I. Jaffee, eds. Phase Stability in Metals and Alloys. New York: McGraw-Hill, 1967. pp. 3-23.

○ **Other comments, if any**

Authors should complete the declaration of competing interest statement using the template available in the journal's instruction webpage and upload to the submission system at the Attach/Upload Files step. If there are no interests to declare, please choose the first option in the template.

STRUCTURE, STYLE, AND FORMAT REVIEW

○ **CLARITY OF PRESENTATION**

The quality of presentation in the article is good. The manuscript is well-written and its purpose is clearly stated. The research objective is consistent across all the sections of the article. The logical flow of the manuscript content is clear, simple and understandable. Repetitive information presented in some sections affect readability and hence was avoided.

The aim of the study is highlighted adequately. However, a restructuring of the Methods section was required to present the content in a defined manner with a better flow. The writing throughout the article is clear and concise, however, we have further edited the content to present a more focussed research for the readers. The flow of language throughout the article appears easily understandable, however, minor ambiguities existed at some places that have been revised. Additionally, the article had many grammatical errors, which we have rectified in the edited manuscript. Many sections as pointed out in the comments needed revision/rephrasing which we have addressed. Please check and confirm if the research presentation is in line with your experimental makeup of the study.

○ **ORGANIZATION AND STRUCTURE**

The manuscript is well organized into various sections such as Abstract, Introduction, Experimental, Results and Discussion, Conclusions and References. The figures and tables representing the core objectives of the study are also adequate and well presented.

The methods section had a continuous layout of content that affected the readability and finding of appropriate sections based on experimental parameters taken in this study. This section has been divided into sub sections to add clarity to the above aspect. Please refer to the comments inside the manuscript.

○ **FORMAT AND STYLE**

The length of the article is as per standard guidelines of journals in similar research area. Please note that this journal does not have any limitation of word count for the paper. However, the article has been edited at several instances to retain the word count at an acceptable number.

The abstract had a word count of 199, which is within the acceptable range of most journals. Please note that this journal has not indicated about any specific limit to the word count for this section.

The manuscript is well-written and the style followed is simple, clear, and readable and facilitates logical flow throughout the study after the edit. All the sections of the manuscript are coherent and convey the key objectives



of the study in a clear manner. The sections are neatly labelled and appropriately numbered which enables good readability of the manuscript.

○ AUTHORSHIP

It complies with the journal's guidelines; however, the author should provide a declaration of interest. It is mandatory for the journal.

SUITABILITY TO JOURNAL INSTRUCTIONS

Journal Scope	'Materials Science and Engineering A' journal covers research about the theoretical and experimental studies related to the load-bearing capacity of materials as influenced by their basic properties, processing history, microstructure and operating environment. Manuscripts should include scientific and/or engineering factors which affect the microstructure - strength relationships of materials and report the changes to mechanical behavior.
Journal quality and coverage	Impact factor – 4.652 Indexed databases – Science Citation Index, Chemical Abstracts, and Scopus Quartile ranking – Q1

○ MANUSCRIPT COMPATIBILITY

The scope of this study is in line with the aims/scope of the recommended journal. However, the author should make all the revisions as suggested.

The journal has a high impact factor and high ranking in which the edited and revised manuscript on Incoloy alloys will stand a suitable chance of publication. The journal has also recently published similar papers in this field.

The journal's indexing in well-reputed databases will ensure wide readership.

CONCLUSIVE STATEMENTS FROM THE EXPERT

The paper reports about an interesting research indicating that for each aging temperature, the coarsening kinetics of the γ' phase was simulated by using JMatPro, and the simulation results were consistent with the experimental results for the mean diameter of the γ' precipitates in each alloy. These findings have the potential to attract the wider audience in this field of study, provided that the paper is revised based on the suggestions provided above.



ACKNOWLEDGE

Scientific Editing Support

The Committee on Publication Ethics (COPE) & ICMJE guidelines specify that the English language reviewers (non-authors) of your manuscript should be acknowledged. We request you to simply include this sentence to comply:

"The authors would like to thank Enago (www.enago.com) for the manuscript review and editing support."

