

FRACTOGRAPHY REPORT GENERAL ANALYSIS OF SUPPLIED MATERIAL

TO: Perfect Point, Inc. ATTN: Mervyn Rudgley 15192 Triton Lane Huntington Beach, CA 92649 **PROJECT NO.:** 6032-106551-4 **REVISION NO.:** 0 **DATE:** June 16, 2021 **AUTHORIZATION:** P1073-SBIR2

PROJECT: Per customer's request, Metcut Research Inc. performed the following:

- 1. Fractography of both fracture faces via SEM method.
- 2. General assessment of fracture face.
- 3. Location and size of each initiation site.
- 4. Number of initiation sites.
- 5. Chemical variance at initiation site(s).
- 6. Identification of any anomalies (if they exist).

Material:ASample No.:BSpecimen Size:10Number of samples:2

AL7075-T651 BY 14 and YREC 14 106551-1 Rev. 2

SUMMARY:

Please find the enclosed images acquired from material submitted to Metcut Research Inc. Images were acquired in Backscattered Electron Imaging (BEI) mode and Secondary Electron Imaging (SEI) mode to clearly show the initiation site(s). Additional questions or concerns can be discussed at the customer's convenience.

Christopher S. Starr, Eng. Assistant II Materials Analysis Laboratory, and Central Coatings Laboratory

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Thomas B. McCall, Eng. Assistant I Materials Analysis Laboratory, and Central Coatings Laboratory

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I. INTRODUCTION:

As requested by customer and as presented in the following review, an assessment of material from the supplied samples has been completed. Standard laboratory techniques were used for each requested task. This includes, but was not limited to, SEM review of fracture faces of supplied specimens. Metcut's latest procedural revisions applied to all tasks performed. All data has been inserted into the report for customer review.

II. DATA AND CONCLUSION:

The first task was to remove and clean each sample prior to placement in SEM chamber. Fracture surfaces on both sides of hole were then reviewed where initiation occurred. All observations about the specimen(s) are outlined in the figures below including number of initiation sites, location and size. An EDS detector was used to provide qualitative analysis of any elemental variation at the initiation if applicable.

SEM micrographs of the sample(s) are presented in the following figures. Low magnification and intermediate magnification images are presented followed by higher magnification images where the initiation site has been identified. Sample orientation is retained with each image unless noted.

All final interpretations are left to customer. Metcut will, at customer's discretion, discuss in more detail any of the observations that have been made. Please feel free to contact us at your convenience with additional comments or questions.



Figure 1. Fracture face of sample BY 14, Site 1 is shown at low magnification, (SEI mode, 0° tilt). The red box identifies the initiation site.



Figure 2. Fracture face of sample BY 14, Site 1 is viewed at intermediate magnification, (SEI mode, 0° tilt). A red box identifies the initiation site.



Figure 3. Initiation site for specimen BY 14, Site 1 is seen at higher magnification, (BEI mode, 0° tilt). Inclusion at the surface measuring 12.0 µm x 17.9 µm was observed as the only initiation site. Inclusion contains mostly Aluminum with concentrations of Iron and Copper.



Figure 4. Initiation site for specimen BY 14, Site 1 is seen at higher magnification, (SEI mode, 15° tilt).



Figure 5. Fracture face of sample BY 14, Site 2 is shown at low magnification, (SEI mode, 0° tilt). The red box identifies the initiation site.





Figure 6. Fracture face of sample BY 14, Site 2 is viewed at intermediate magnification, (SEI mode, 0° tilt). A red box identifies the initiation site.

Figure 7. Initiation site for specimen BY 14, Site 2 is seen at higher magnification, (BEI mode, 0° tilt). Inclusion at the surface measuring 3.8 µm x 9.4 µm was observed as the only initiation site. Inclusion contains mostly Aluminum with concentrations of Iron, Copper and Zinc.



Figure 8. Initiation site for specimen BY 14, Site 2 is seen at higher magnification, (SEI mode, 15° tilt).



Figure 9. Fracture face of sample YREC 14, Site 1 is shown at low magnification, (SEI mode, 0° tilt). The red box identifies the initiation site.



Figure 10. Fracture face of sample YREC 14, Site 1 is viewed at intermediate magnification, (SEI mode, 0° tilt). A red box identifies the initiation site.



Figure 11. Initiation site for specimen YREC 14, Site 1 is seen at higher magnification, (BEI mode, 0° tilt). Inclusion at the surface measuring 12.6 µm x 36.1 µm was observed at the initiation site. Inclusion contains mostly Aluminum with concentrations of Iron and Copper.



Figure 12. Initiation site for specimen YREC 14, Site 1 is seen at higher magnification, (SEI mode, 15° tilt).



Figure 13. Fracture face of sample YREC 14, Site 2 is shown at low magnification, (SEI mode, 0° tilt). The red box identifies the initiation site.



Figure 14. Fracture face of sample YREC 14, Site 2 is viewed at intermediate magnification, (SEI mode, 0° tilt). A red box identifies the initiation site.



Figure 15. Initiation site for specimen YREC 14, Site 2 is seen at higher magnification, (BEI mode, 0° tilt). Inclusion at the surface measuring 12.6 µm x 36.1 µm was observed at the initiation site. Inclusion contains mostly Aluminum with concentrations of Iron, Copper, Silicon and Chromium.



Figure 16. Initiation site for specimen YREC 14, Site 2 is seen at higher magnification, (SEI mode, 15° tilt).