National Transportation Safety Board
Office of Research and Engineering
Washington, DC 20594

ERA23FA137

MATERIALS LABORATORY

Factual Report 23-083

November 17, 2023

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A. ACCIDENT INFORMATION

Location: Lindenhurst, NY
Date: 3/5/2023
Vehicle: Piper PA 28-161, N8149R
Investigator: Brian Rayner

B. COMPONENTS EXAMINED

Two fuel priming lines and one oil pressure line with fittings (Figure 1).

C. EXAMINATION PARTICIPANTS

Group Chair	Joseph Panagiotou National Transportation Safety Board Washington, DC
Engineering Technician	Edward Komarnicki National Transportation Safety Board Washington, DC

D. DETAILS OF THE EXAMINATION

The two fuel priming lines (Figure 2) would have been attached to a manually operated fuel priming pump in the cockpit. The two lines have been arbitrarily labeled #1 and #2 as it is not known which one was attached to the suction and which one was attached to the pressure side of the manual pump. Both lines were copper and approximately 0.125 inch outside diameter. Examination of the copper tube by X-Ray fluorescence spectroscopy[1] found the alloy to contain approximately 99.6% Cu. Fuel priming line #1 exhibited a melted and tapered end (Figure 3). Fuel priming line #2 exhibited an area along the tube exterior with localized melting and foreign material adhering to the tube's exterior surface (Figure 4).

Priming tube #2 was examined using a scanning electron microscope (SEM). The areas examined were labeled 1 – 4 as designated in figure 4. Area #1 was outside the area of apparent damage and exhibited small voids on the surface as well as spherical globules adhering to the surface (Figure 5). Area #2 was within a region that appeared to have had melted and resolidified exhibiting a rippled surface morphology (Figure 6). Area #3 was in the area where the tube wall had been penetrated through its full thickness. This area #3 exhibited a cleaved surface morphology (Figure 7). Area #4 was on the tube's exterior where it appeared that

[1] Using a Thermo Scientific Niton XL3t-980 hand held x-ray fluorescence analyzer.

foreign material was adhering to the surface (Figure 8). An Energy Dispersive Spectroscopy (EDS) map of the region in area #4 with Cu and Al overlay is shown in Figure 9.

The oil pressure line consisted of an approximately 0.250 inch copper tube that would have extended from the firewall to an oil pressure gauge on the instrument panel. The oil pressure line had a Tee fitting approximately midspan along its length (Figure 10). This Tee fitting created a branch line that terminated at a partially melted fitting (Figure 11). The Tee fitting, branch line and melted end fitting were not part of the original oil pressure line design. It is unknown what had been connected to the melted fitting. The melted fitting was examined using a digital microscope (Figure 12). The fitting exhibited a concentrated region of melted and missing material. In some areas the melted region was flanked by intact material on either side. Some of the margins between the melted and intact material exhibited a scalloped like appearance. The morphology of the melting exhibited by the fitting is consistent with localized extreme temperature such as that generated by electrical arcing. Examination of the fitting by X-Ray fluorescence spectroscopy found the alloy to be consistent with a 360 series free machining brass.

Submitted by:

Joseph Panagiotou
Fire Protection Engineer

Figure 1. Two fuel priming lines and one oil pressure line with fittings as received.

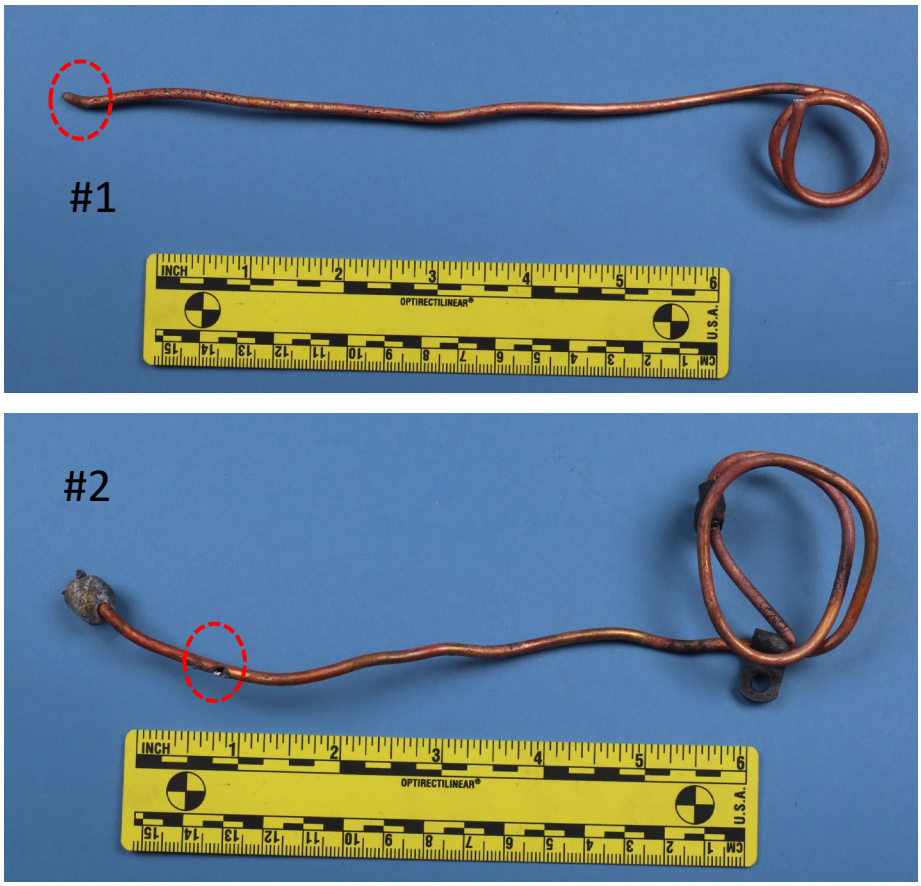

Figure 2. Fuel primer lines with areas of damage indicated by red circles.

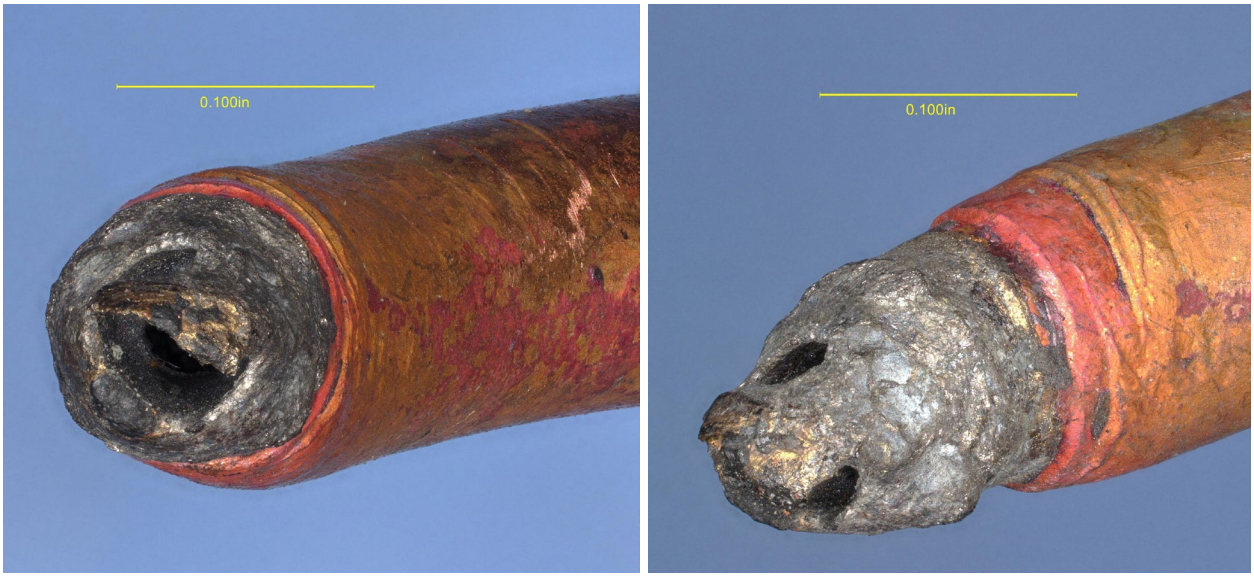

Figure 3. Melting on the end of primer line #1.

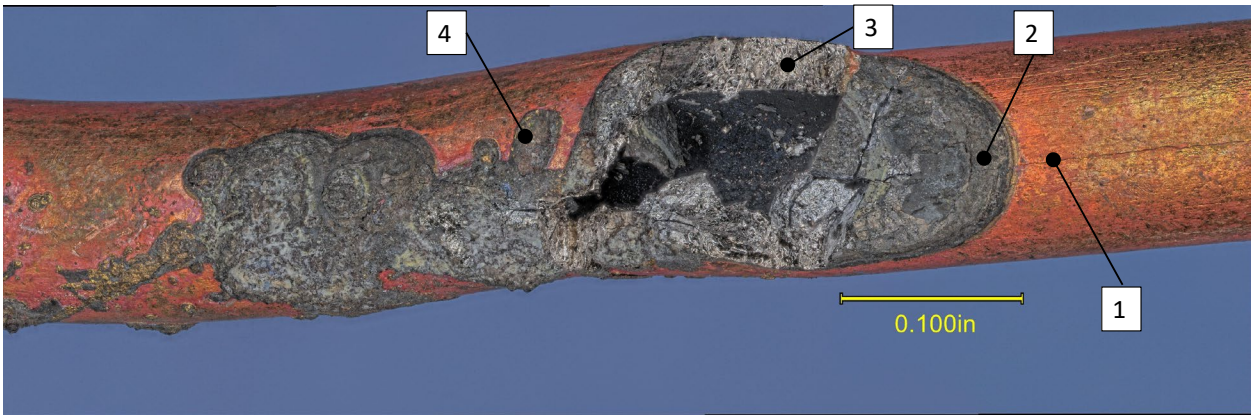

Figure 4. Damage on the surface of primer line #2.

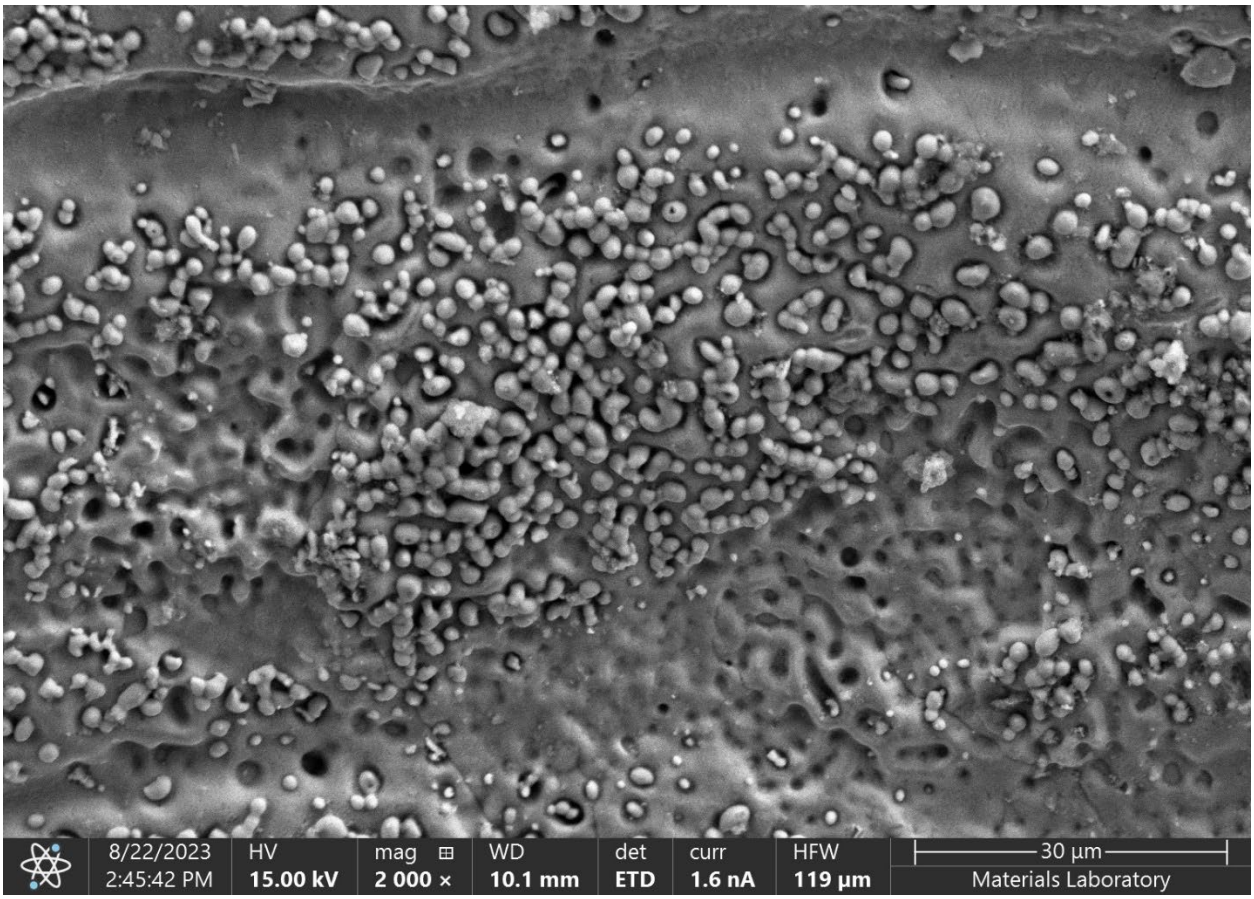

Figure 5. SEM micrograph from area #1.

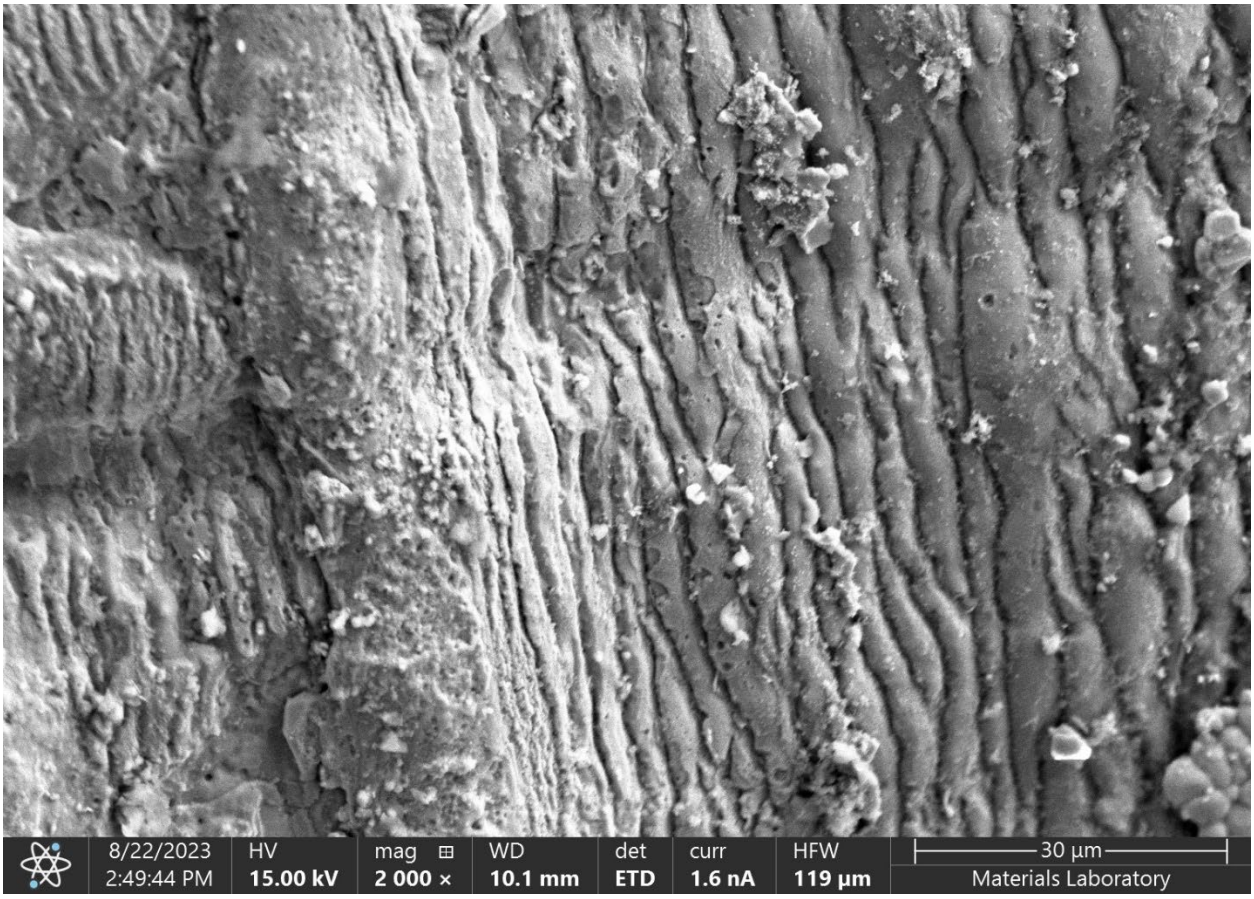

Figure 6. SEM micrograph from area #2.

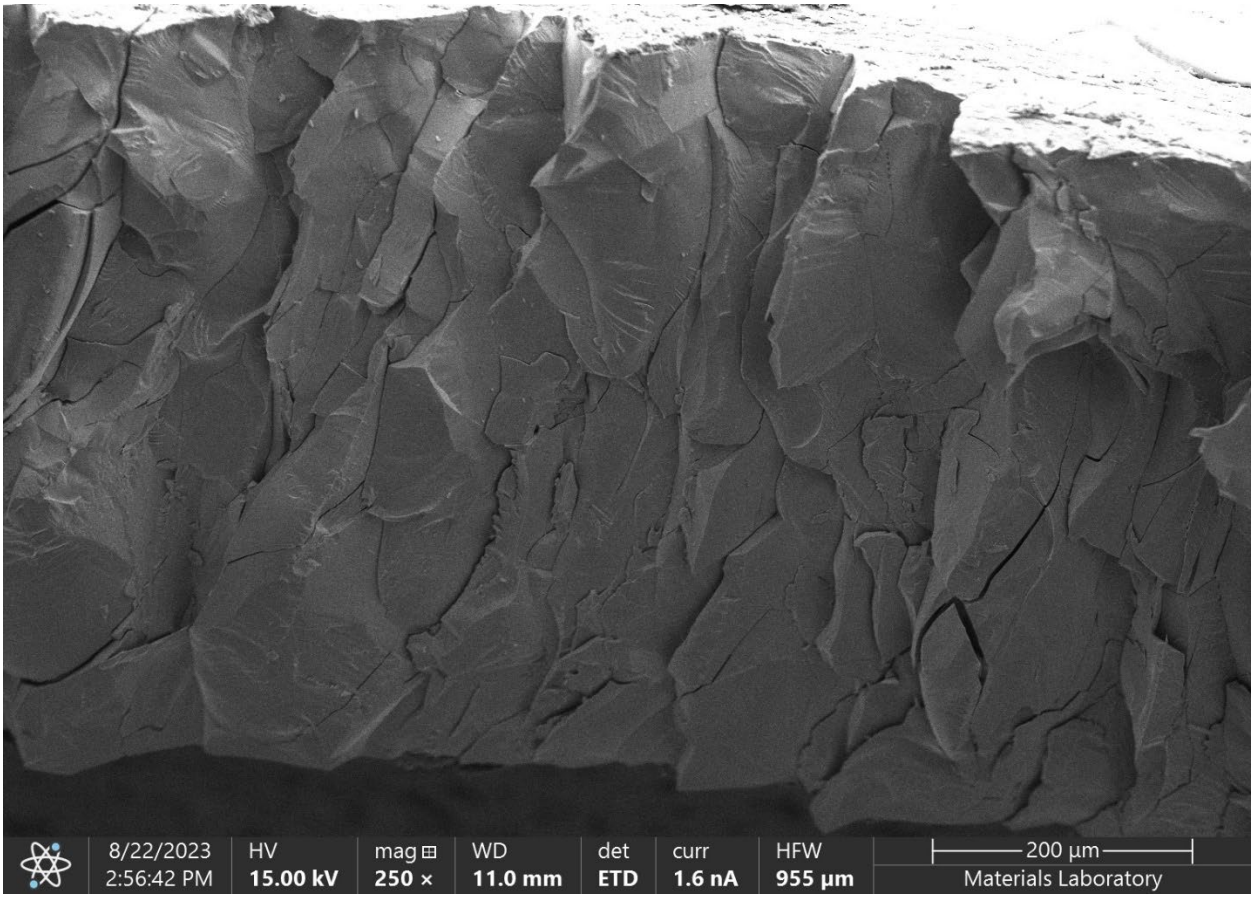

Figure 7. SEM micrograph from area #3.

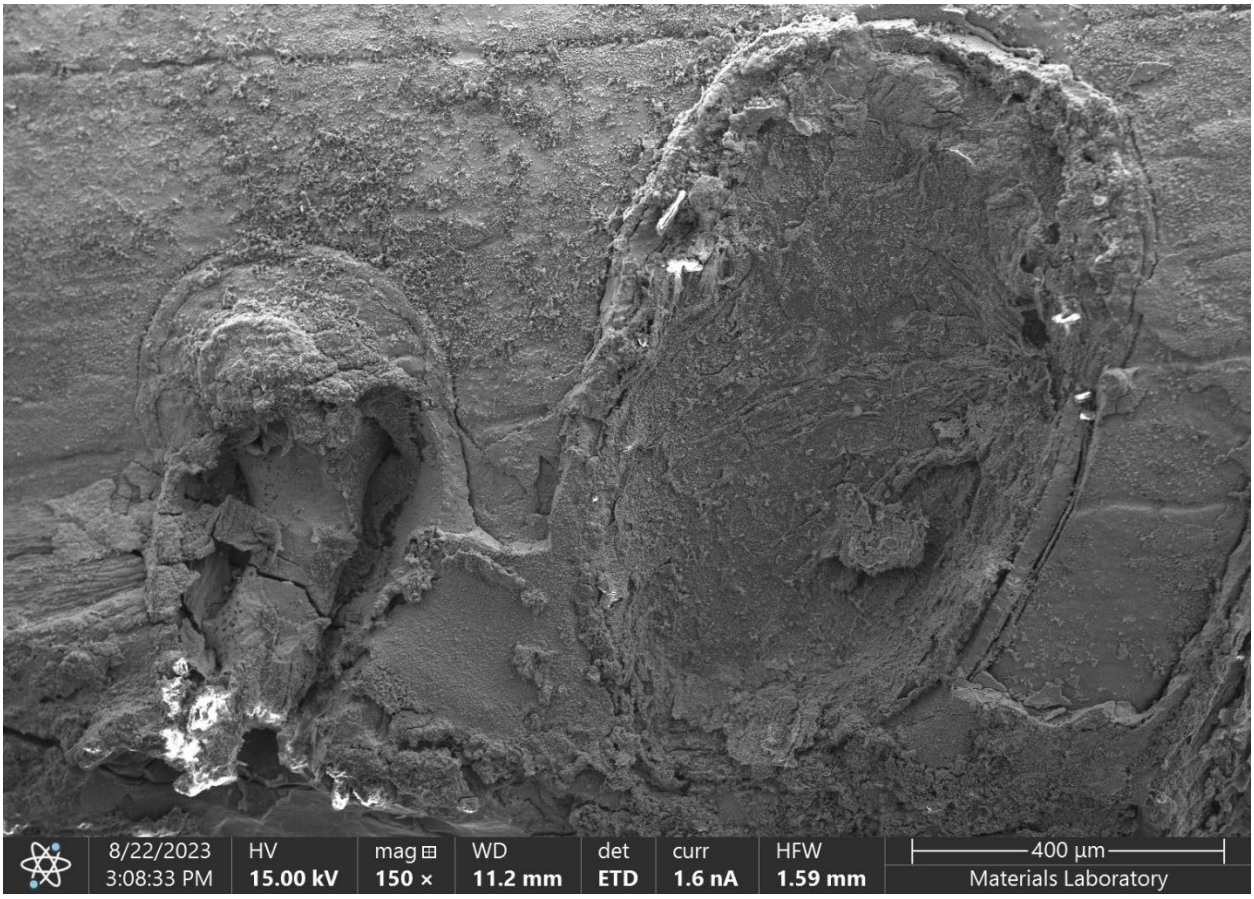

Figure 8. SEM micrograph from area #4.

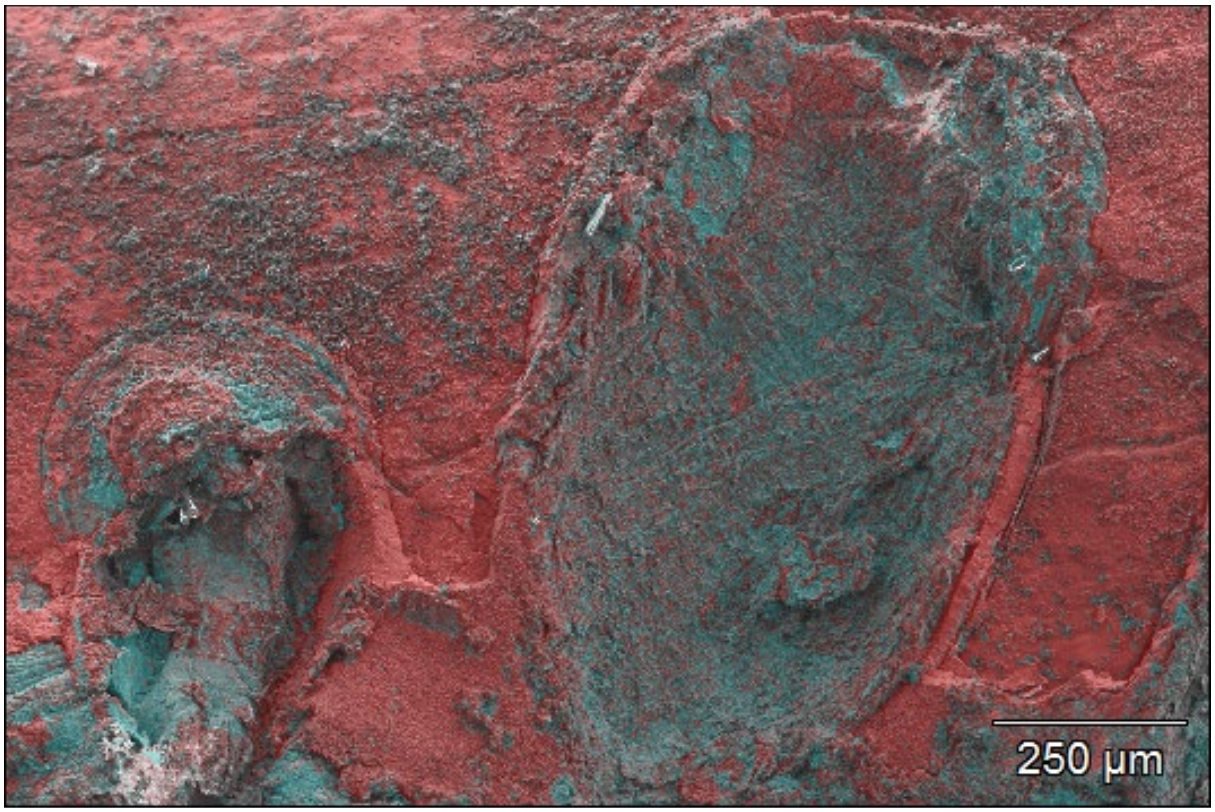

Figure 9. EDS Map of area #4 showing overlaid elements Cu (red) and Al (green).

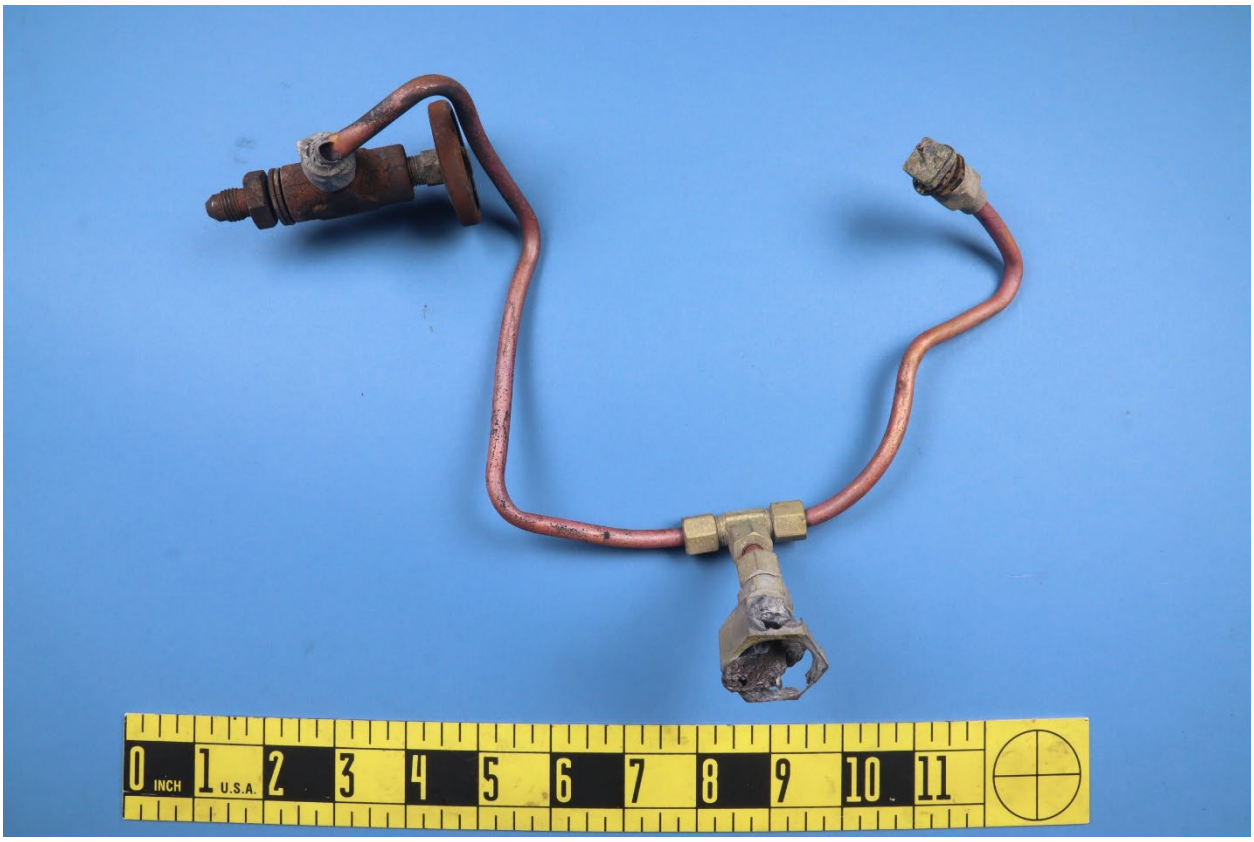

Figure 10. Oil pressure line with Tee fitting mid span.

Figure 11. Branch line with damaged fitting on the end.

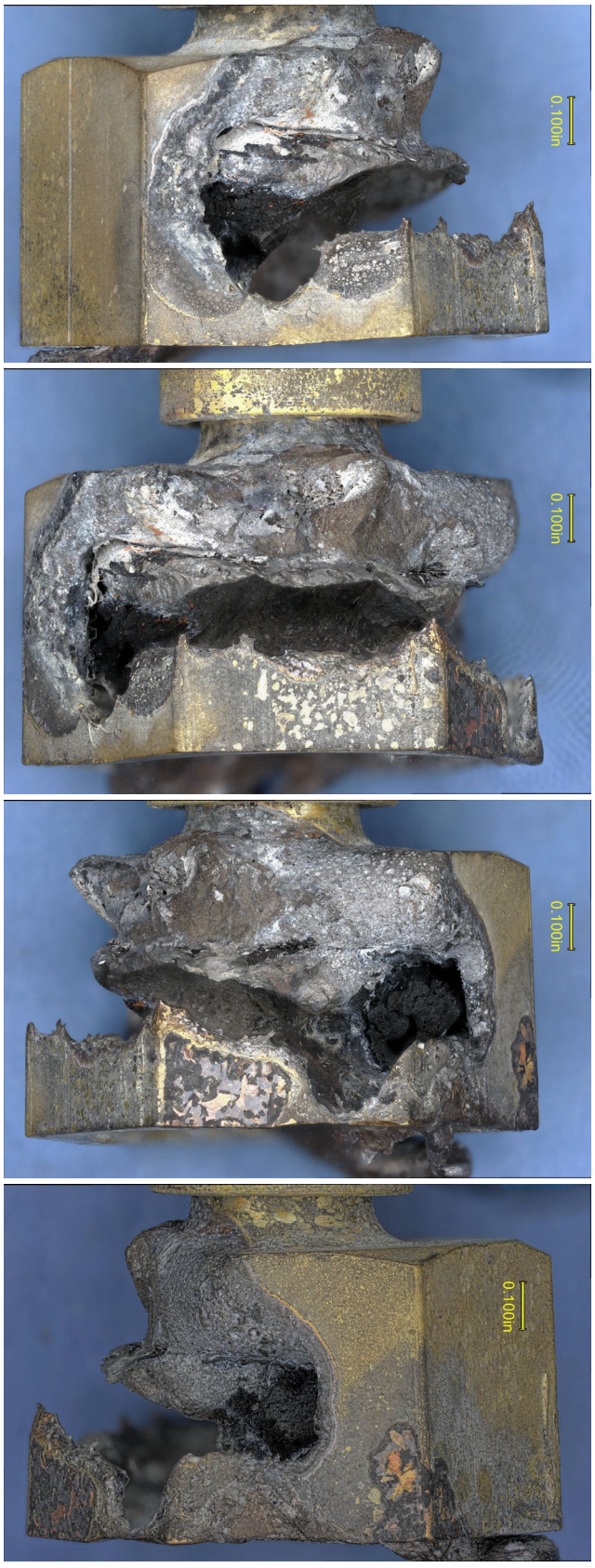

Figure 12. Multiple views of melting on oil line fitting.