

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22LA221

MATERIALS LABORATORY

Addendum Report 23-052B

August 21, 2023

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A. ACCIDENT INFORMATION

Location: Stockton, California
Date: June 17, 2022
Time: 06:00 central daylight time
13:00 coordinated universal time
Vehicle: Bell 206B, N90326
Investigator: Fabian Salazar, AS-WPR

B. COMPONENTS EXAMINED

Debris extracted from a tail rotor blade

C. EXAMINATION PARTICIPANTS

Specialist Erik Mueller, Ph.D., P.E.
Office of Research and Engineering - Materials Laboratory Division
NTSB, Washington, DC

D. DETAILS OF THE EXAMINATION

The reported titled *23-052 Materials Laboratory Factual Report* detailed a previous examination of fractured tail rotor blades, exemplar tail rotor blades, and a 90° gearbox from a Bell 206B helicopter. After this examination, the tail rotor blades were sent to one of the party members, Van Horn Aviation, for additional examination. They reported that some debris had been discovered within one of the tail rotor blades, and this debris was sent to the NTSB Materials Laboratory for additional examination. The details of the investigation of this debris are detailed in this report.

Figure 1 shows the debris in a small plastic bag, as received. The debris exhibited a dull, dark color and was brittle enough to crumble upon handling. The debris was examined using ultraviolet light (UV). The debris did not fluoresce under exposure to UV, which was inconsistent with being or containing biological material.

The debris was examined using a field emission scanning electron microscope (SEM). A typical area is illustrated in Figure 2. The debris exhibited electrical charging effects consistent with nonmetallic material at higher accelerating voltages. The debris could be imaged at lower voltages, as shown in Figures 2 through 4. The debris exhibited a rounded globular structure, with regions of voids or absent solid material.

The chemical composition of the debris was examined using energy-dispersive x-ray spectroscopy (EDS). Figure 5 illustrates a typical EDS spectrum from the debris. The material exhibited high silicon, oxygen, aluminum, and carbon peaks. There were also minor peaks of sodium, potassium, iron, titanium, magnesium, phosphorus, and

calcium. No spectra were observed that were substantially different than the one shown in Figure 5 from EDS probes of the debris.

Lastly, the debris was examined using Fourier-transform infrared spectroscopy (FTIR). Figure 6 shows a typical spectrum of the material, shown in black. This was compared against known standards and matched the one of a copolymer between acrylonitrile and butadiene, shown in red. This spectrum was consistent with a nitrile rubber material. No other material spectra were identified that matched those obtained from the debris' infrared examination.

Submitted by:

Erik M. Mueller
Materials Research Engineer



Figure 1. The debris removed from the tail rotor blade, as received.

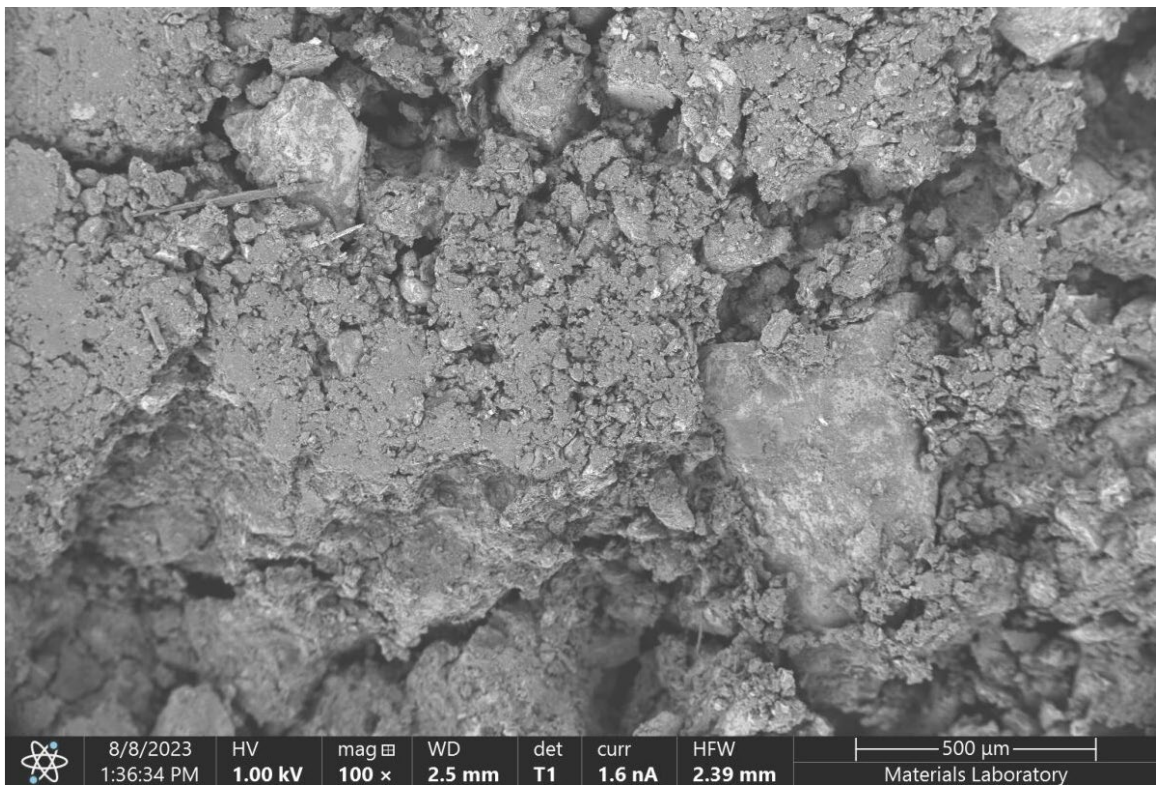


Figure 2. Backscattered electron (BE) micrograph of a typical area of the debris.

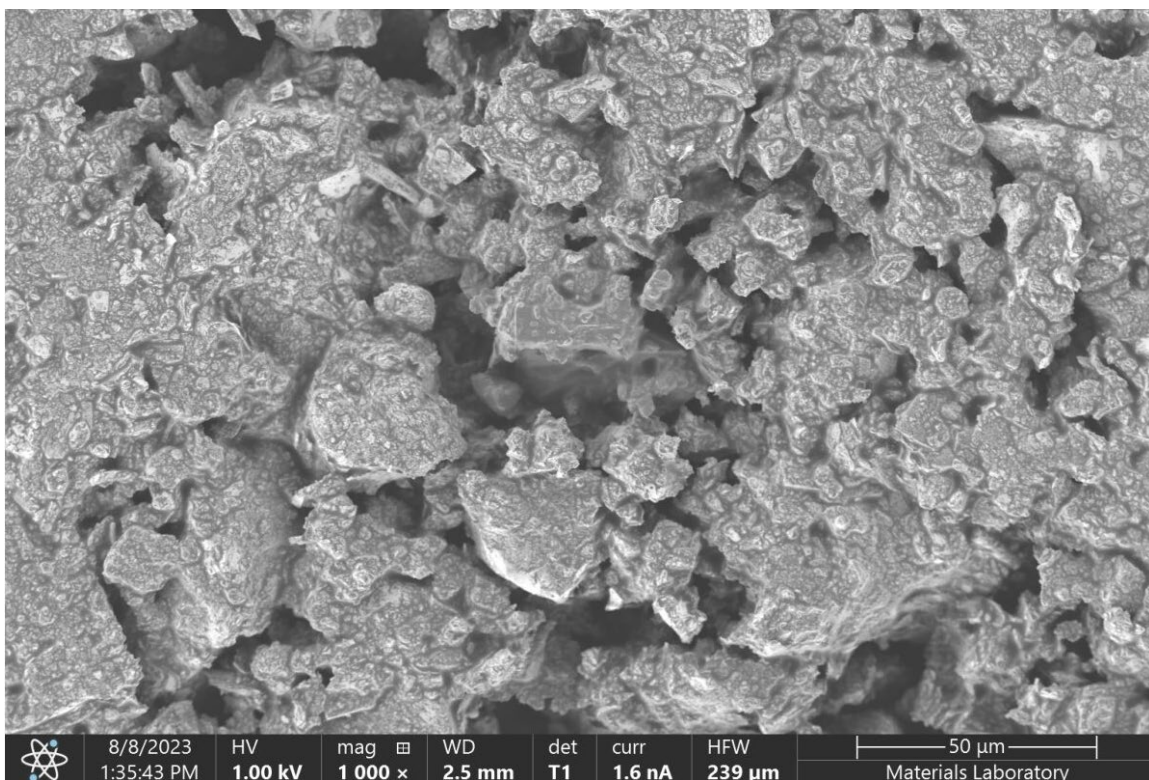


Figure 3. BE micrograph of a closer view of the derbis in Figure 2.

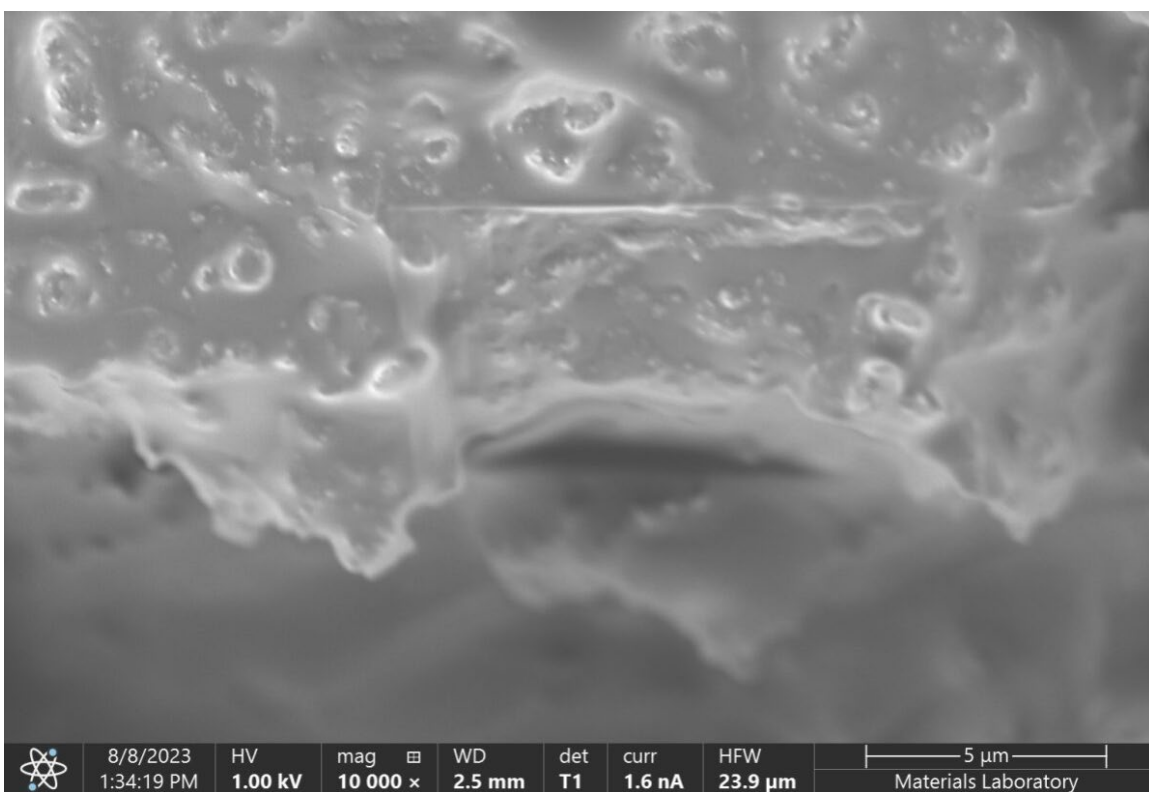


Figure 4. BE micrograph of the center lump in Figure 3.

Full scale counts: 3816
Integral Counts: 125231

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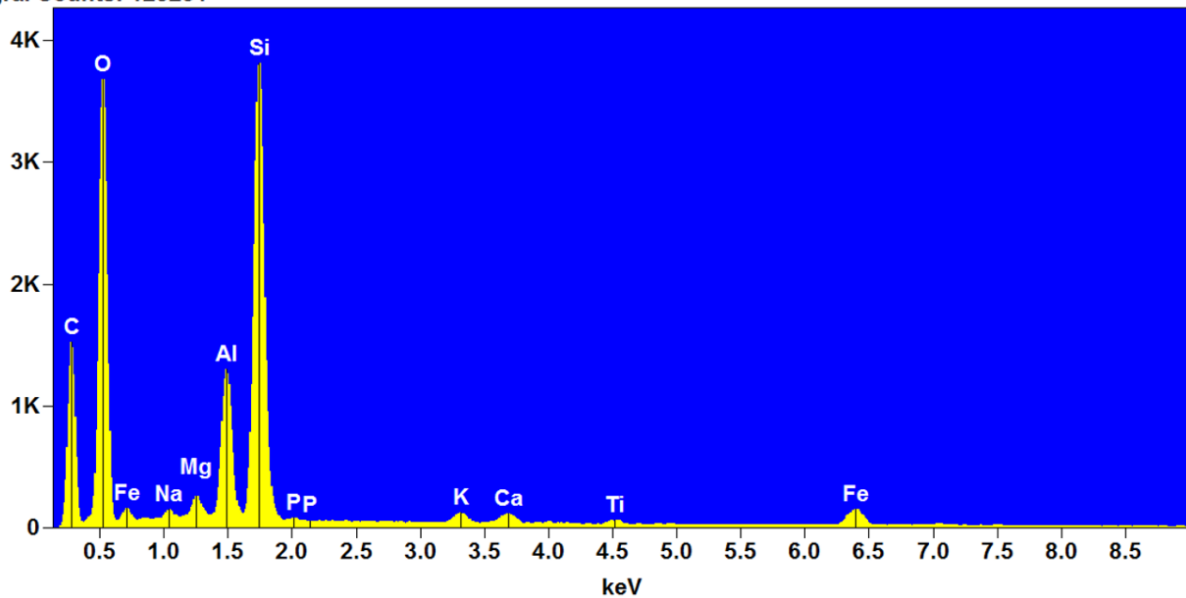
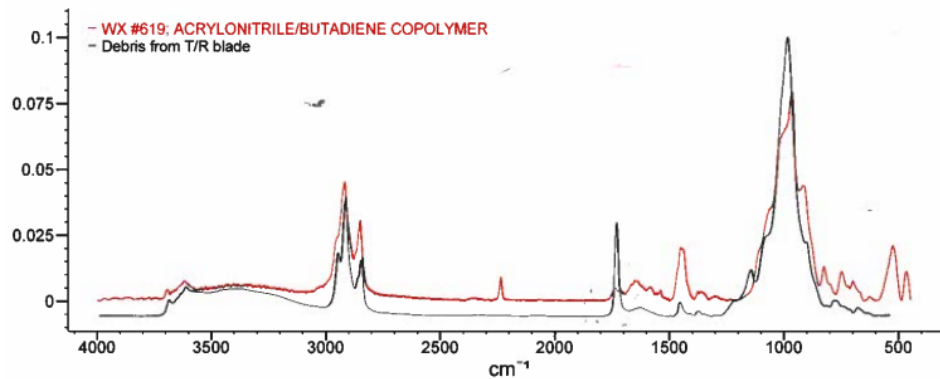


Figure 5. EDS spectrum of a typical area in Figure 2.



HQI	Tag	Correctio	DB	ID	Name	Spectrum
91.80			WX	619	ACRYLONITRILE/BUTADIENE COPOLYMER	

Figure 6. FTIR spectra comparison, showing the spectrum of a selected area of debris from the tail rotor blade debris (black) compared with a standard spectrum of acrylonitrile-butadiene copolymer (red).