

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN21LA265

MATERIALS LABORATORY

Factual Report 22-057

November 3, 2022

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A. ACCIDENT INFORMATION

Location: Columbus, Ohio
Date: June 14, 2021
Vehicle: Cessna 180K, N13159
Investigator: Jennifer Rodi
AS-CEN

B. COMPONENTS EXAMINED

Fuel distributor spring and diaphragm
Known sealant sample

C. EXAMINATION PARTICIPANTS

Specialist Nancy B McAtee
NTSB/ RE-30
Washington, DC

D. DETAILS OF THE EXAMINATION

The fuel distribution diaphragm and springs as well as a sealant fragments from the fuel tank were submitted to the Materials Laboratory for examination. These components are show in Figures 1 and 2.

There were two visible areas of residue on the surface of the springs. A sample of white powdery residue was removed from the top of the spring and a sample of a darker material adhered to the mid-coil of the spring as shown in Figure 3 were removed from the surface of the spring for further analysis.

The two unknown material samples were examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis and American Society for Testing Materials*). The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material.

For the white residue, the spectrum contained spectral peaks that corresponded to particular functional groups found within the molecular structure of the unknown material. The presence of a broad peak between $\sim 3610\text{ cm}^{-1}$ is indicative of an oxygen-hydrogen bond. A doublet peak at $\sim 2915\text{ cm}^{-1}$ and $\sim 2850\text{ cm}^{-1}$ corresponds to a carbon-hydrogen stretching bond. A single peak at $\sim 1530\text{ cm}^{-1}$ is

indicative of an oxygen-carbon-oxygen (O-C=O) bond. A single medium peak at $\sim 1460\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (2) bending bond. A single medium peak at $\sim 1400\text{ cm}^{-1}$ is indicative a carbon-oxygen stretching bond. The combination of peaks is consistent with a carboxylic acid.

A spectral library comparison search was performed on the residue spectrum. The library search found a strong spectral matched to zinc stearate.

For the dark residue, the spectrum contained spectral peaks that corresponded to particular functional groups found within the molecular structure of the unknown material. The presence of two broad peaks between $\sim 3450\text{ cm}^{-1}$ and 3190 cm^{-1} are indicative of a nitrogen-hydrogen stretching (primary amine) bond. A doublet peak at $\sim 2924\text{ cm}^{-1}$ and $\sim 2853\text{ cm}^{-1}$ corresponds to a carbon-hydrogen stretching bond. A low broad peak at $\sim 2095\text{ cm}^{-1}$ is indicative of a carbon-nitrogen bond (C-N). A single peak at $\sim 1640\text{ cm}^{-1}$ is indicative of a carbon-nitrogen stretching bond or a carbonyl (C=O) bond. A single medium peak at $\sim 1550\text{ cm}^{-1}$ is indicative of a nitrogen-hydrogen bending bond. A medium doublet peak at $\sim 1458\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (2) bond. Peaks at $\sim 1172\text{ cm}^{-1}$, 1071 cm^{-1} and $\sim 1042\text{ cm}^{-1}$ are indicative of a carbon-oxygen bond. A single medium peak at $\sim 847\text{ cm}^{-1}$ is indicative of an oxygen-nitrate (NO_2) bond. The combination of peaks is consistent with an amide.

A spectral library comparison search was performed on the residue spectrum. The library search found no strong spectral matches, but the spectrum did have similarities to several polyamides

A sample of the known sealant sample from the left fuel tank was also examined by FTIR to determine if either residue matched the known sealant material. Spectral comparison of both samples found no correlation/match to the known sealant material.

Submitted by:

Nancy B McAtee
Senior Chemist

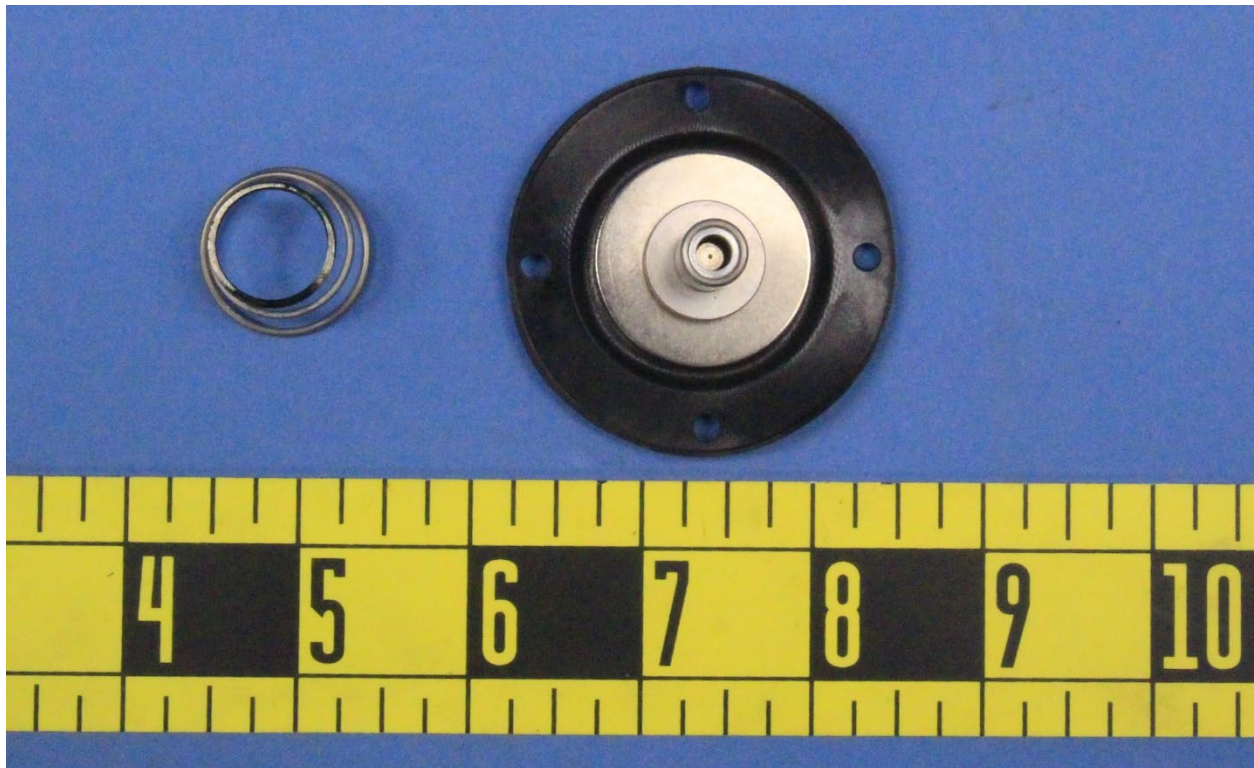


Figure 1. Overall photograph of fuel distributor spring and diaphragm.



Figure 2. Overall photograph of known sealant sample.

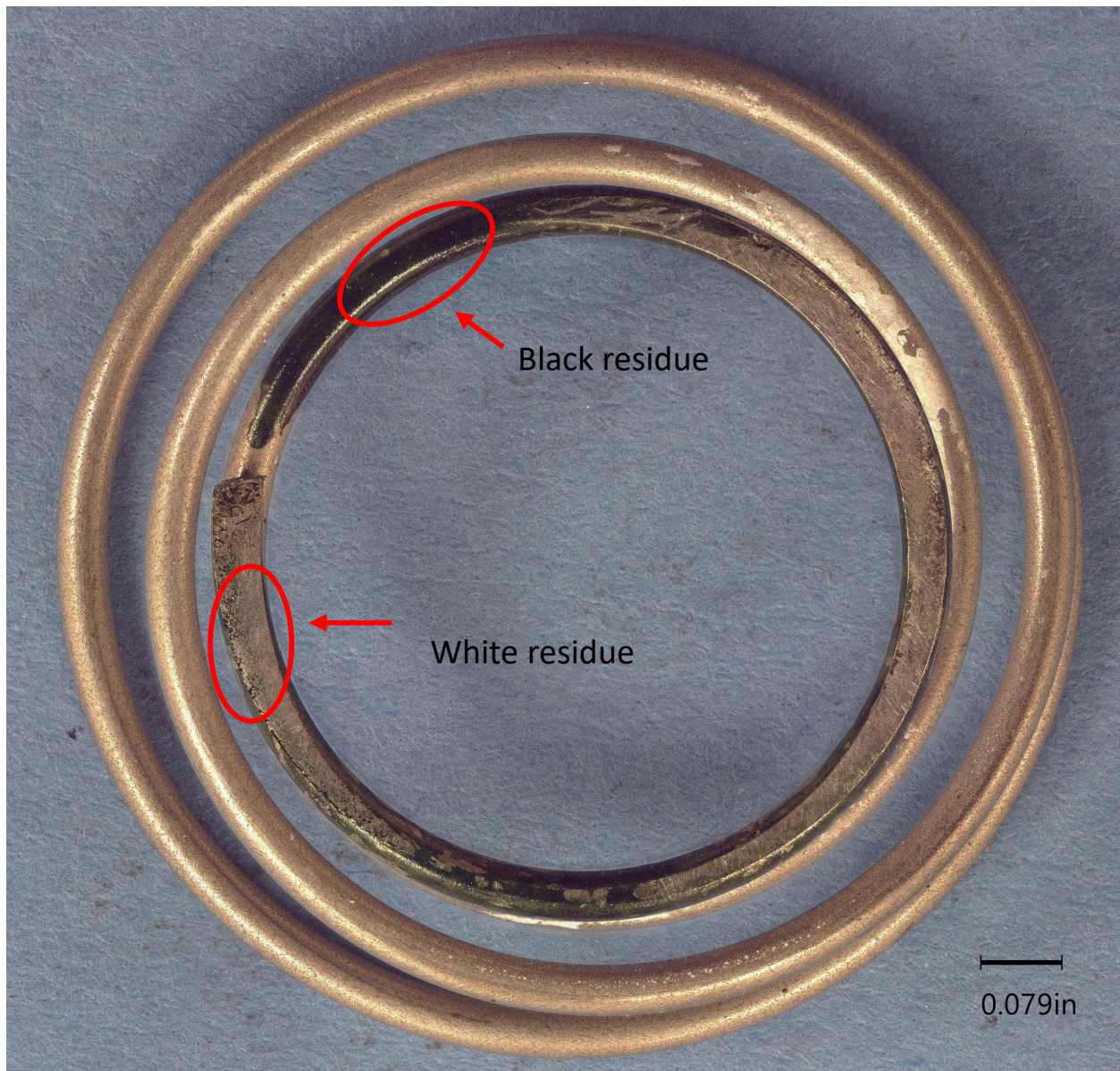


Figure 3. Close-up photograph of fuel distribution spring with sample areas marked.