NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

December 22, 2017

MATERIALS LABORATORY FACTUAL REPORT Report No. 17-089

A. ACCIDENT INFORMATION

Place	:	East Haven, Connecticut
Date	:	February 22, 2017
Vehicle	:	Piper PA 38, 112
NTSB No.	:	ERA17FA112
Investigator	:	Robert Gretz

B. COMPONENTS EXAMINED

Fuel Selector Valve

C. DETAILS OF THE EXAMINATION

The fuel selector valve from the accident aircraft was submitted to the Materials Laboratory for examination. An as received photograph is shown in Figure 1.

The fuel selector valve assembly consisted of a metallic valve housing. Within the outer housing, a metallic shaft connected the operating handle to the selector inset. The shaft was set within the polymeric insert and was secured together with two pins on the shaft that were set into channels in the polymeric inset.

The fuel selector valve was received partially disassembled. The metallic shaft was free from the insert. The top portion (above the pin insertions) of the polymeric inset was fractured into multiple pieces as shown in Figure 2. The lower portion was still present within the metallic body of the valve as shown in Figure 3. The lower portion could not be rotated within the valve body.

The upper surface of the intact portion exhibited multiple points of crack origin included origins in the area of the pin insertions. These areas are characterized by smooth, featureless areas. This is shown in Figure 4. Ridges on the fracture indicated fast crack propagation through the full thickness of the insert. An example of this is shown in Figure 5. In addition, there were several large smeared features that ended with shear lips. The fracture features shown on the surface of the lower insert portion were consistent with rotational ductile overstress.

There was also the presence of abrasive wear on the outer portion of the insert due to contact with burs on the valve housing. The presence of grooves on the surface of the insert as well

as the presence of insert material shavings are indicative of this type of wear as shown in Figure 6.

The material from the polymeric insert was examined to determine the identity of the polymer used. To make this determination, a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (*Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis and American Society for Testing Materials*) was used. The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material.

The spectrum contained spectral peaks that corresponded to particular functional groups found within molecular structure of the unknown material. The presence of a doublet peak at ~2976 cm^{-1} and ~2919 cm^{-1} corresponded to a carbon-hydrogen stretching (alkane) bond. A single peak at ~1235 cm^{-1} was indicative of a carbon-oxygen-carbon asymmetric stretching bond. A single peak at ~1090 cm^{-1} was indicative of a carbon-oxygen-carbon symmetric stretching bond. Peaks at ~1469 cm^{-1} and 894 cm^{-1} were indicative of a carbon-hydrogen (2) bending bonds.

The spectrum from the unknown material suggested that the material was an aliphatic ether. A spectral library search was performed. The spectral search found the insert material was a very strong match to polyoxymethylene (POM) also known as polyacetal.

Nancy B. McAtee
Chemist

Figure 1. Overall photograph of fuel selector valve at intake.

Figure 2. Photograph of fragments of top portion of polymeric inset.

Figure 3. Photograph of lower portion of inset in valve housing.

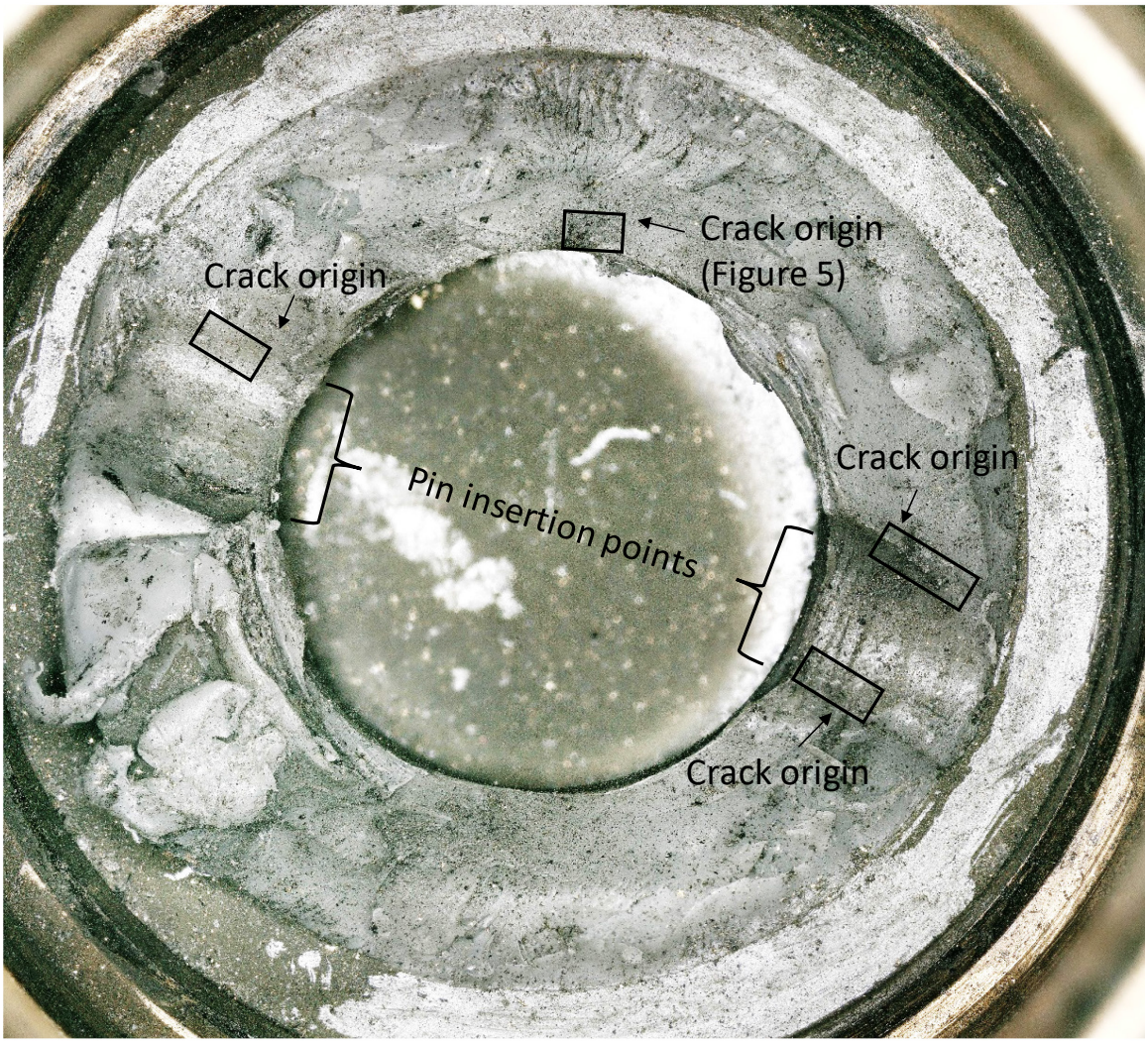

Figure 4. Photograph of fracture face on lower portion of inset.

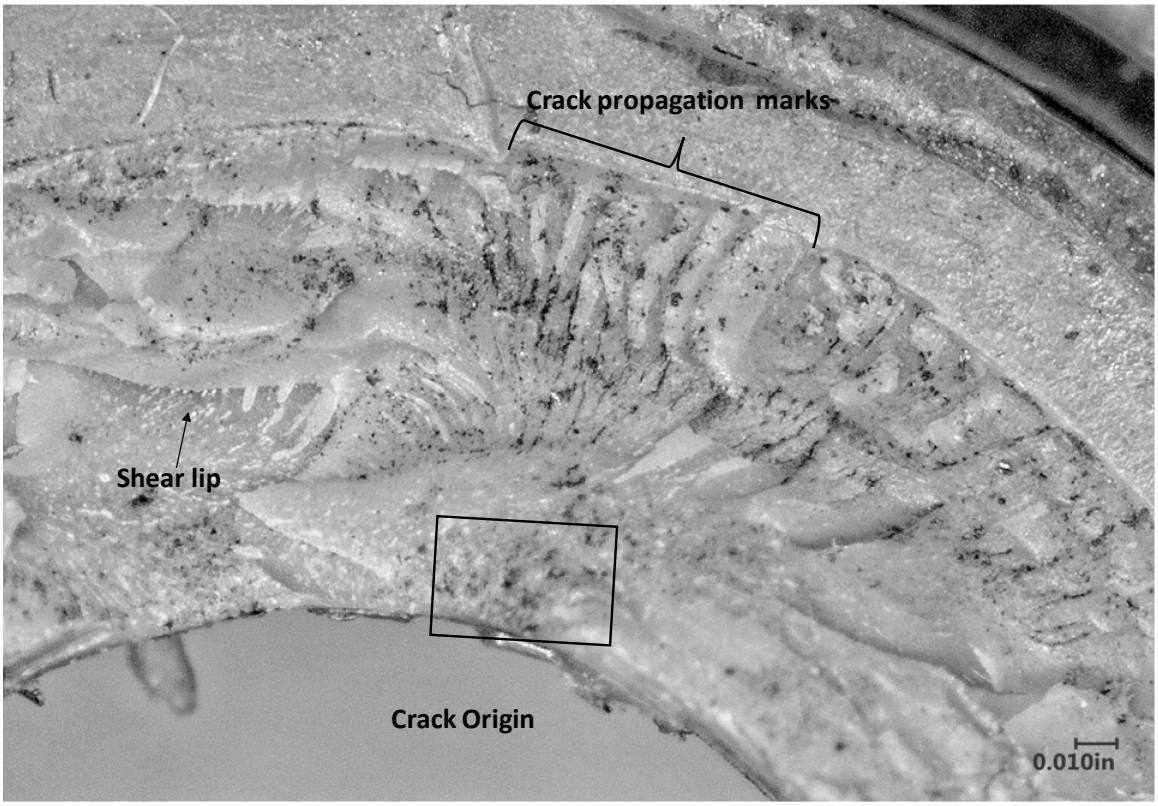

Figure 5. Close-up photograph of one of the crack origin areas on the lower inset portion.

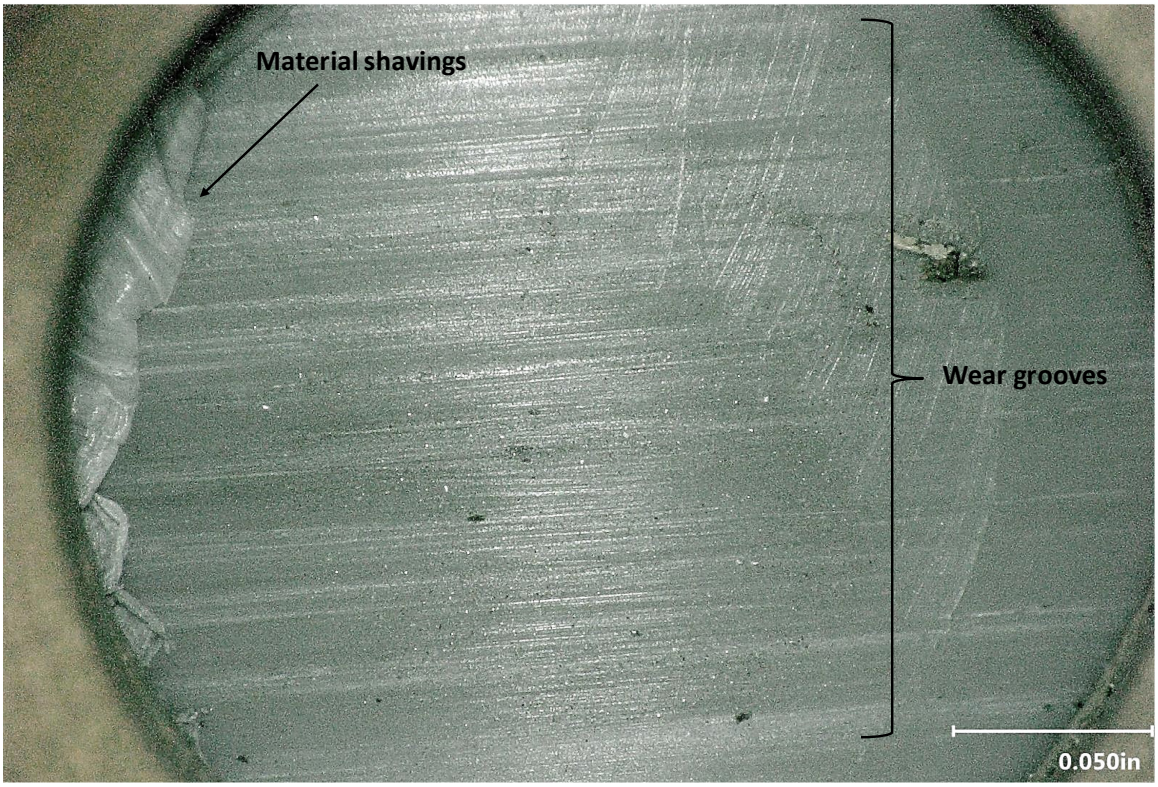

Figure 6. Close-up photograph of abrasive wear on side of insert.