

Communication Summary

11/16/2015

Information From: Ms. Nancy B McAtee, NTSB Chemist



Summary & Factual Information:

Ms. McAtee reported that a swab with a black residue recovered from the engine cylinder of the accident aircraft was submitted to the Materials Laboratory. The unknown residue on the swab was 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.

The spectrum contained spectral peaks that corresponded to particular functional groups found within molecular structure of the unknown material. The presence of a broad peak between $\sim 3700\text{ cm}^{-1}$ and $\sim 3550\text{ cm}^{-1}$ is indicative of an oxygen-hydrogen bond. A doublet peak at $\sim 2923\text{ cm}^{-1}$ and $\sim 2853\text{ cm}^{-1}$ corresponds to a carbon-hydrogen stretching bond. A weak doublet peak at $\sim 2350\text{--}2250\text{ cm}^{-1}$ is indicative of elemental carbon (soot). A weak peak at $\sim 1645\text{ cm}^{-1}$ is indicative of a nitrogen-oxygen bond. A single medium peak at $\sim 1460\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (2) bending bond.

The spectrum from the unknown material suggested that the residue was a straight-chained aliphatic hydrocarbon with the presence of degradation products (water (O-H), NO_x (N-O) oxidation and soot). A spectral library search found a spectral match to several mineral based lubricating oils. Visual examination by the analyst confirmed this match. The spectral match, combined with the presence of several known degradation products of engine oil, indicates that the residue is consistent with degraded engine oil.

I can attest that the above summary is correct to the best of my knowledge:

Edward F. Malinowski
National Transportation Safety Board
Air Safety Investigator