

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



November 19, 2019

MATERIALS LABORATORY FACTUAL REPORT

Report No. 19-065

A. ACCIDENT INFORMATION

Place : La Belle, Florida
Date : April 14, 2018
Vehicle : S.Z.D. SZD-48 JANTAR STD 2, N456RM
NTSB No. : ERA18FA128
Investigator : Eric Alleyne, ASI-ERA

B. COMPONENTS EXAMINED

Two pieces of a right-wing speed brake connecting rod assembly with fractured rod end.

C. DETAILS OF THE EXAMINATION

Two pieces of a right-wing speed brake connecting rod assembly were submitted to the NTSB Materials Lab for examination as shown in figure 1a. The assembly consisted of a connecting rod that was coupled to a beveled gear by means of a rod end. The rod end consisted of a threaded portion on one side and a clevis on the other side. The rod end was fractured through the threaded portion as shown in figures 1a and 1b.

The bolt that connected the clevis to the beveled gear was removed and the rod end piece was cleaned using an alkaline detergent solution, a nylon bristle brush, and a sonicating bath. An image of the fracture surface after cleaning is shown in figure 2a. The fracture surface exhibited two distinct visual morphologies. Several regions exhibited a rough/matte appearance, while other regions exhibited a comparatively reflective or specular appearance, as indicated in figure 2a. A shear lip was observed adjacent to a keyway in the threaded section of the rod and a secondary crack was observed near an internal edge of the keyway.

The threaded section of the rod end was visually bent. The rod end piece was rotated about the axial direction to determine the direction of maximum bend. That orientation, shown in figure 2b was at an angle of approximate 35° to the rotation axis of the beveled gear.

The fracture surface was examined using a scanning electron microscope (SEM) to examine the rough/matte and specular fracture regions. An overview SEM image of the fracture is shown in figure 3. One of the specular fracture regions is indicated and enclosed by a yellow dashed line and one of the matte regions is also indicated. Representative images taken from each region are shown in figures 4a and 4b for the

matte and specular regions respectively. The matte region exhibited a dimpled appearance consistent with a ductile overstress fracture. The specular region exhibited a flat faceted appearance consistent with a brittle cleave fracture.

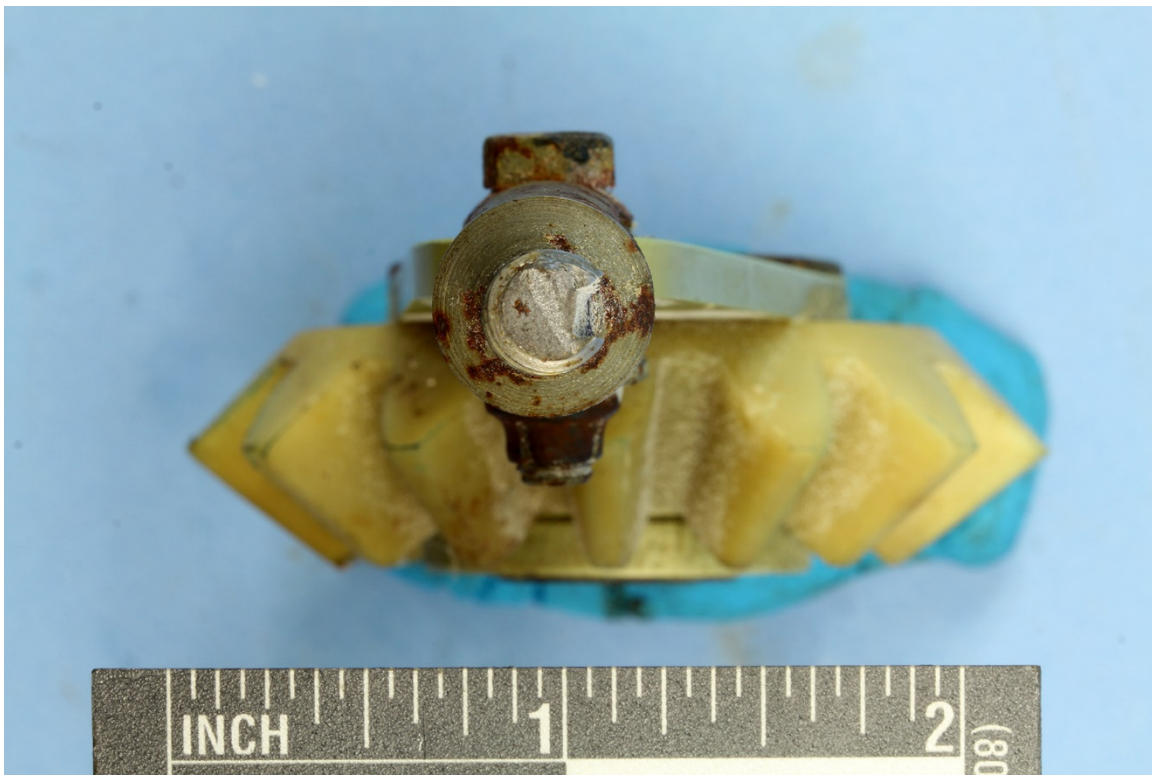
The fracture surface on the tensile side of the bend was examined visually and determined to exhibit a matte appearance. Based on the SEM observations, this appearance was consistent with the crack initiating by ductile overstress.

In conclusion, the deformation and fracture features were consistent with a ductile bending overstress fracture that started in a thread root with the bending axis at an angle of approximately 35° to the rotation axis of the beveled gear. The fracture mode subsequently transitioned between brittle and ductile overstress with the point of final fracture near the keyway.

Donald Kramer, Ph.D.
Sr. Materials Engineer



a)



b)

Figure 1: Images of the speed brake connecting rod assembly as received: a) side view and b) threaded rod axial view.

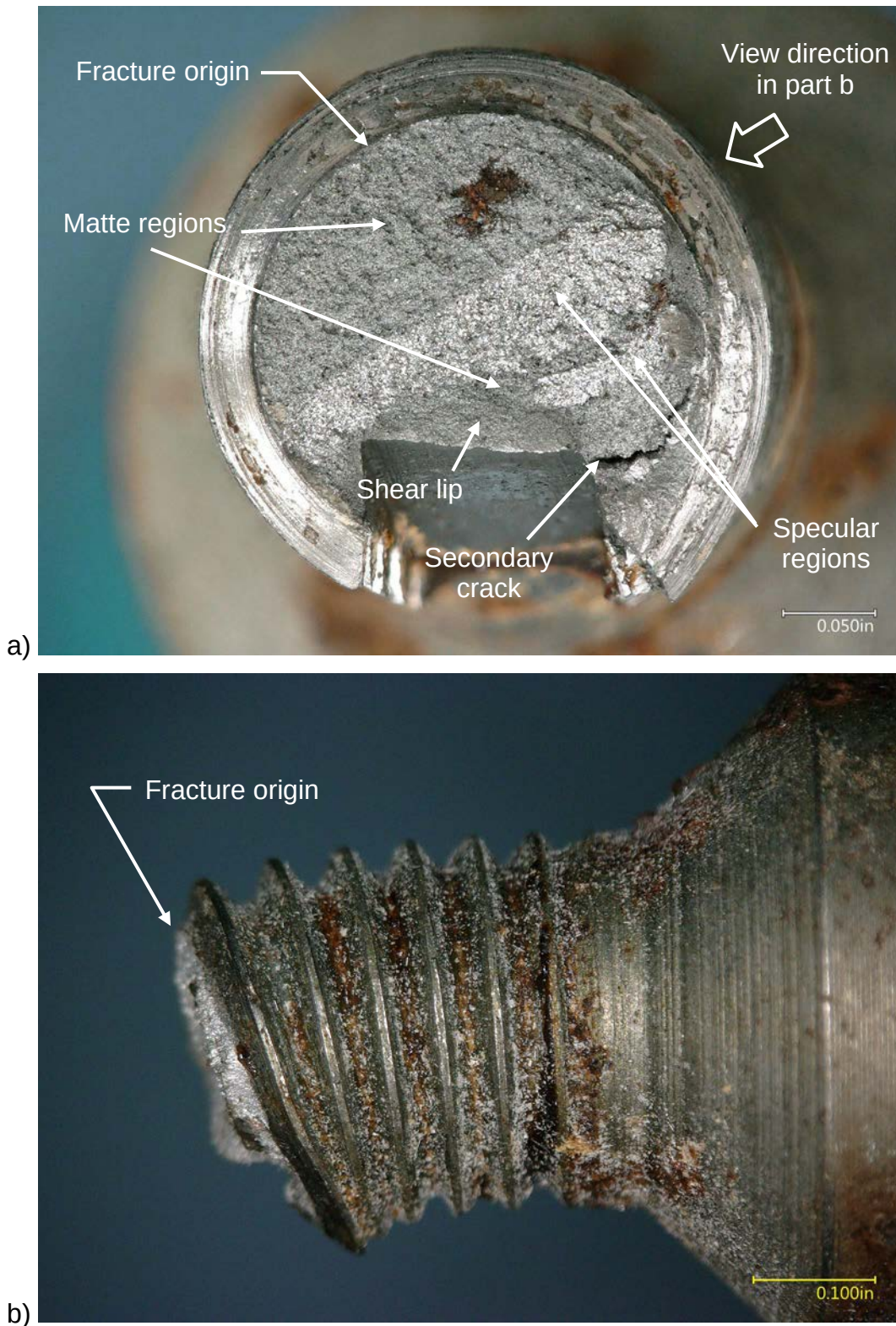


Figure 2: a) Image of the threaded rod fracture surface and b) side view of the threaded section at an angle of approximately 35° to the clevis and beveled gear rotation axis.

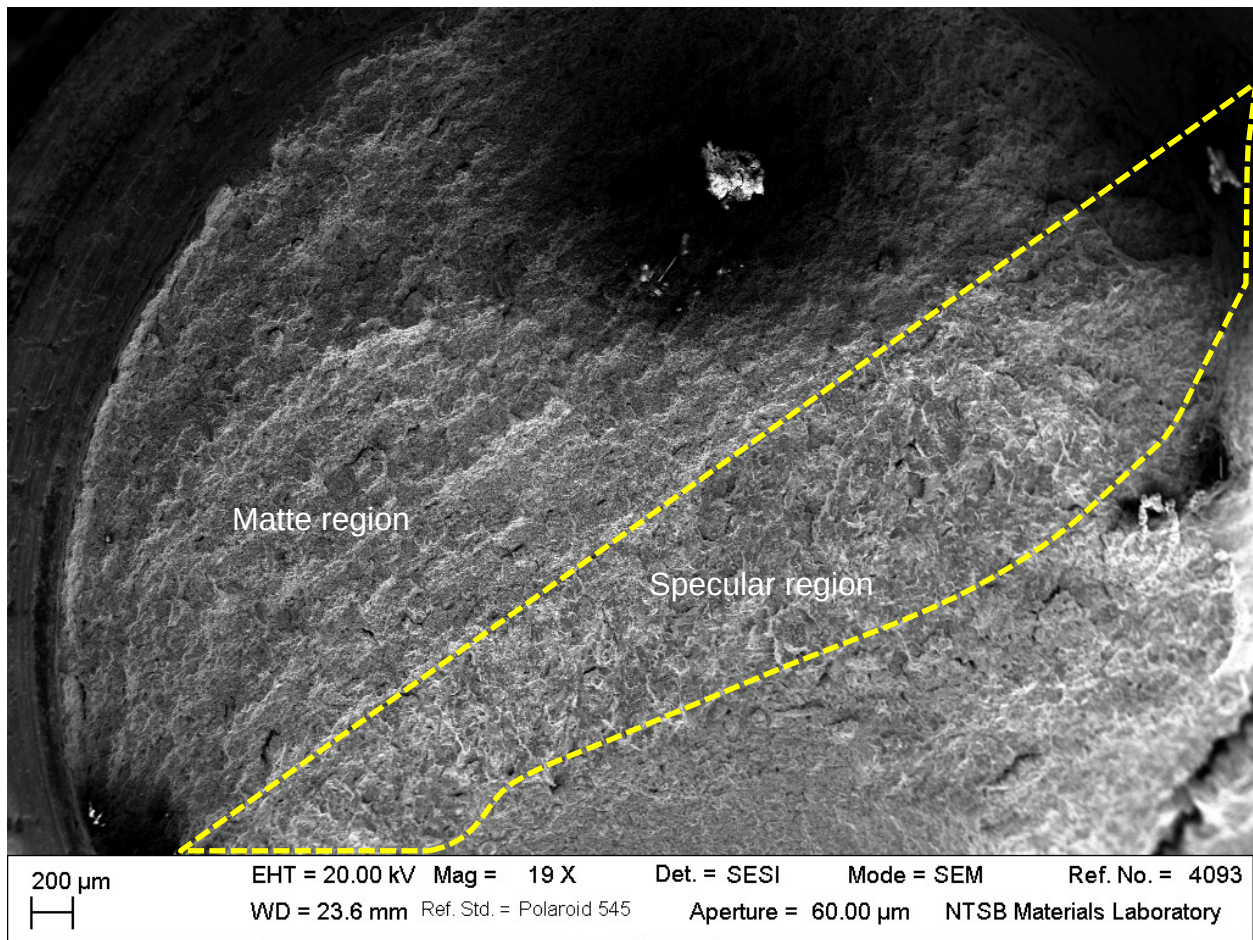


Figure 3: Overview SEM image of the fracture surface.

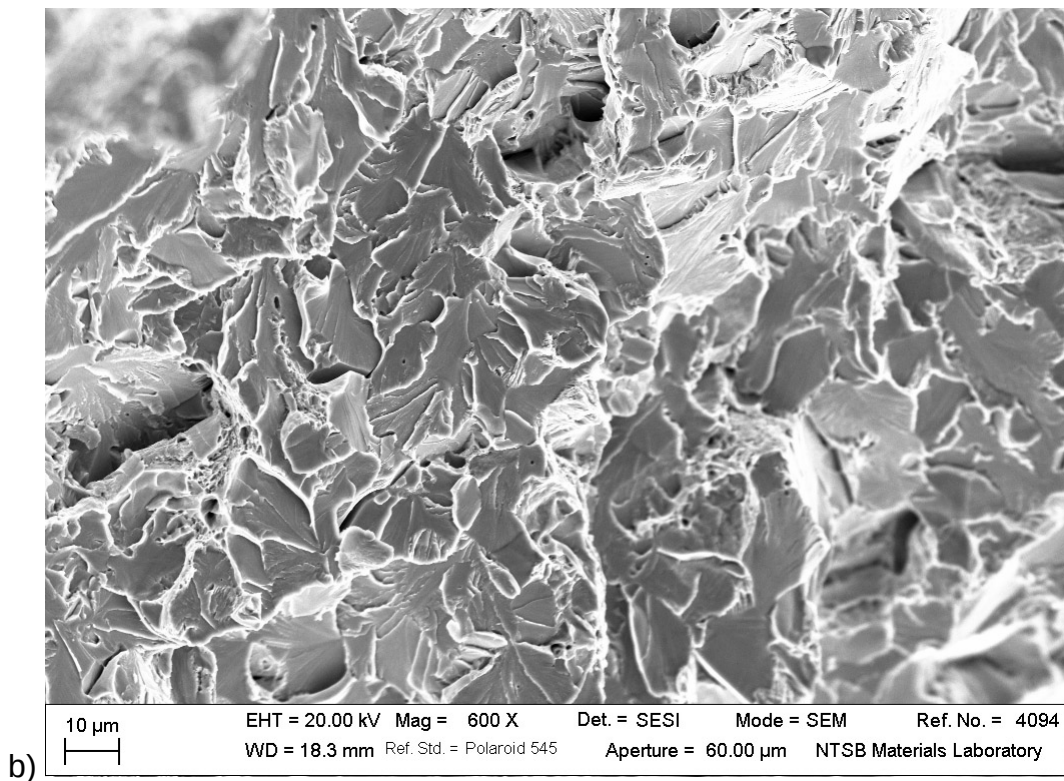
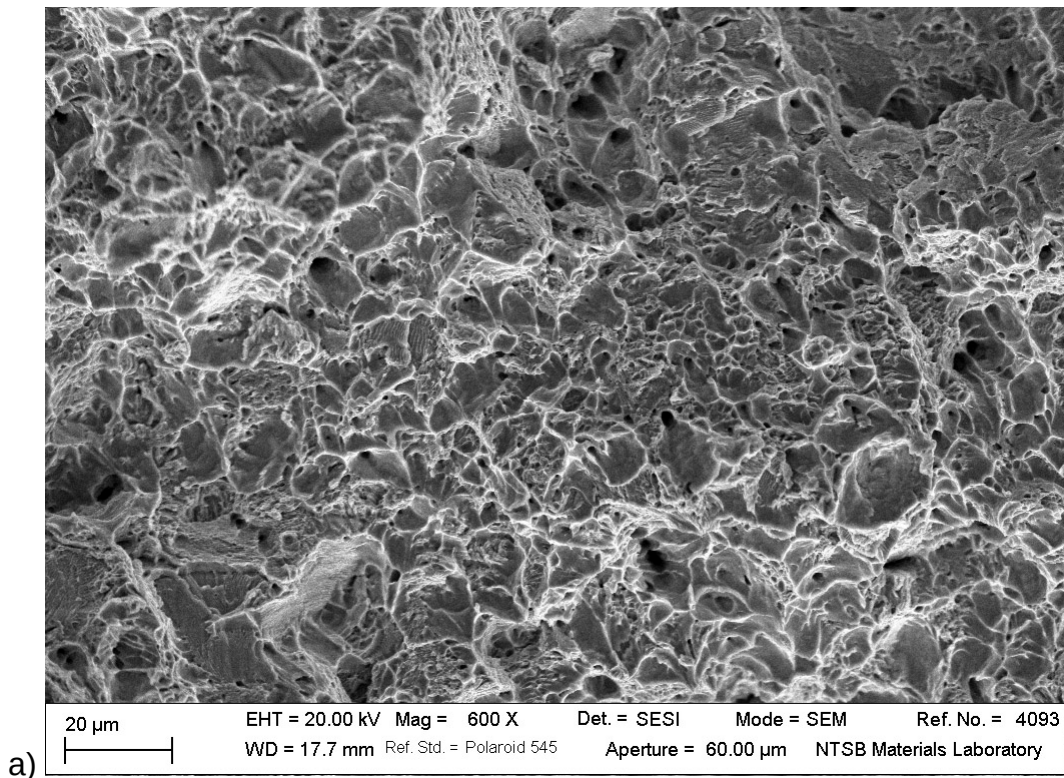


Figure 4: SEM images of typical fracture surface features from regions indicated in figure 3: a) ductile dimple morphology in matte region and b) flat faceted fracture in specular region.