

# Report on Fractured Bead in Tire

Kenneth C. Russell

Department of Materials Science and Engineering

Massachusetts Institute of Technology

Cambridge, Massachusetts

June 5, 1975

## Conclusions

1. There was no evidence of defects in materials or workmanship in the broken wire tire bead.
2. The beading failed in a ductile manner, as a result of a stress applied along the bead axis.
3. The fracture did not occur as a result of a mechanical mounting procedure and inflation of the tire to a pressure the order of  $25 \text{ lb/in}^2$ .

## General

On March 11, 1975 I received the tire shown in Fig. 1. The tire was described to me as a recap, which had flown off a mounting machine at about 25 lb. internal pressure, causing personal injury. Hand manipulation showed the bead to be fractured at a location bracketed by the chalk marks in Fig. 1. I was asked to investigate the fracture and in particular to determine whether or not it occurred during the mounting process.

## Results

Figures 2, 3 and 4 are photographs of the ends of the fractured bead wires. All the wires are seen to have broken in the ductile "cup-cone" made characteristic of sound, ductile material. This type of fracture comes from a stress being applied along the axis of the wire. Failure due to fatigue, or to bending the bead or striking it from the side, could not give this type of fracture.

Figure 5 is a photomicrograph of the internal structure of the bead wire. The material is a heavily drawn pearlitic steel, which is an appropriate material for the bead.

Thus, the bead is of an appropriate material, which fractured in a ductile manner due to the application of a stress along the wire axis. The most probable means by which such a stress is applied is over inflation. Inflation would have to be far above the 25-30 psi operating level to fracture the cord. A pressure the order of 100 psi would be a reasonable estimate of the required inflation.



Figure 1: Subject tire, as received.



Figure 2: View of bead wires, showing ductile fracture.

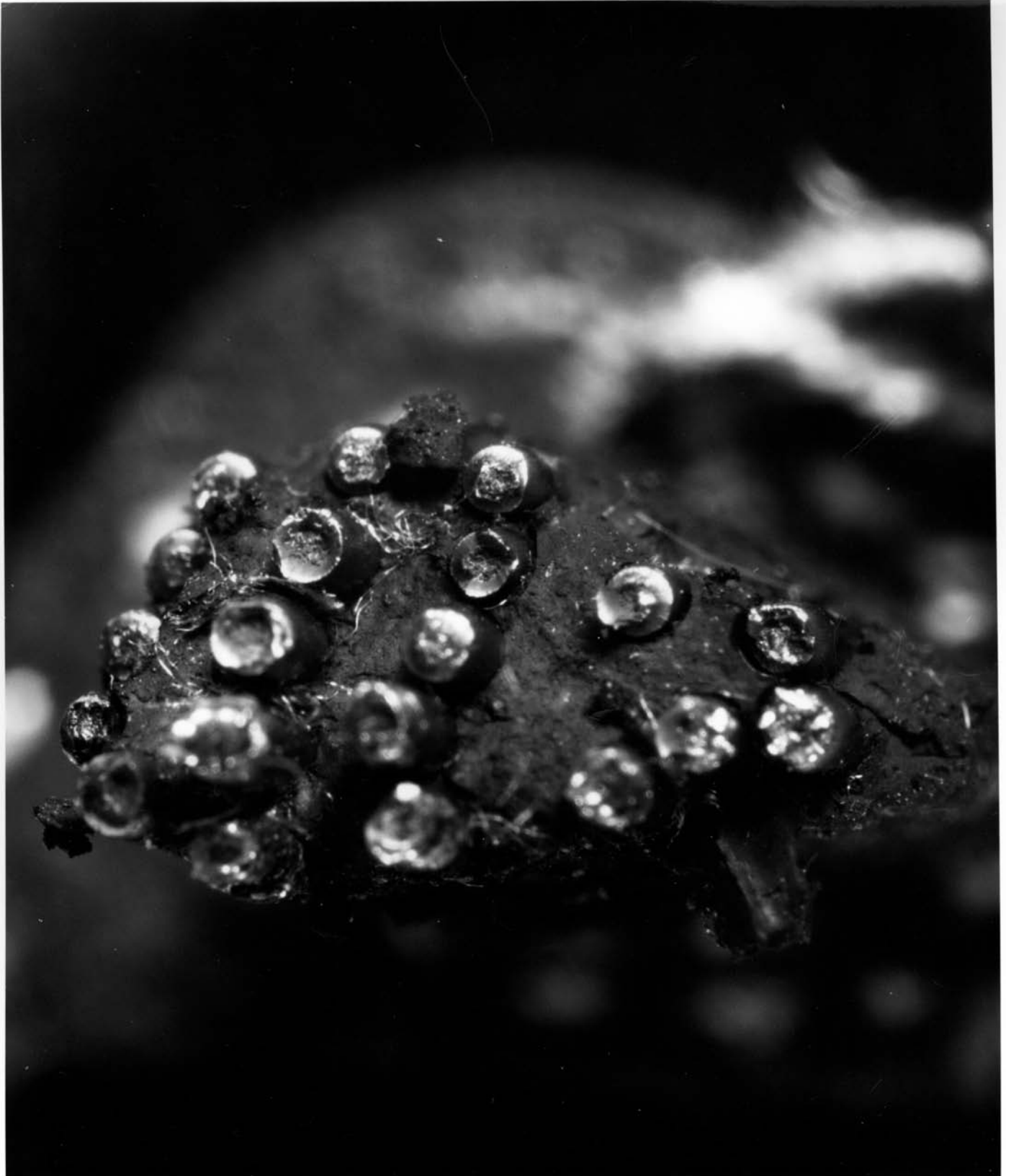


Figure 3: Another view of bead wires, showing ductile fracture.



Figure 4: Side view of bead wires, showing ductile fracture.

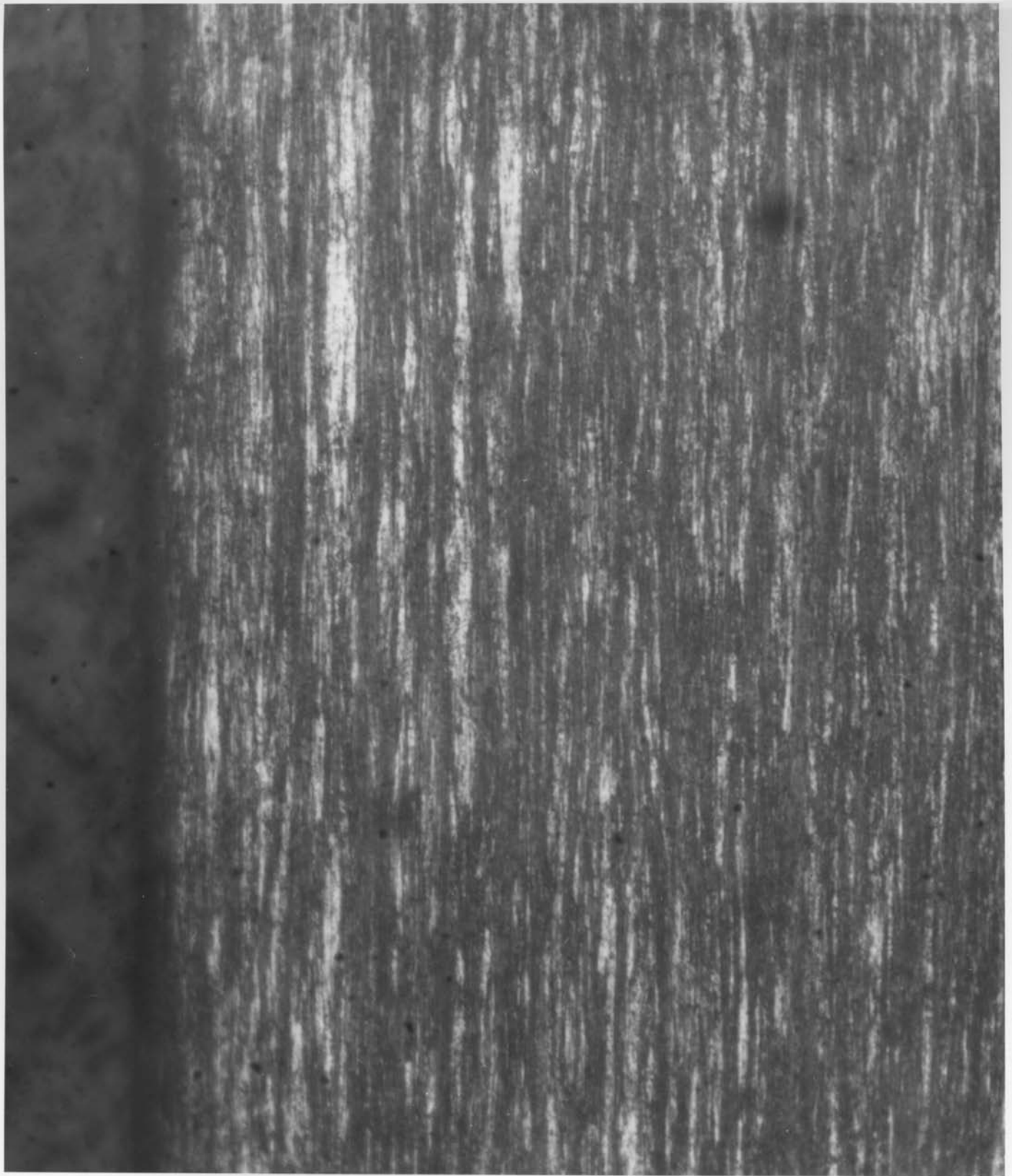


Figure 5: Longitudinal section of fractured bead wire, showing the cold-drawn internal structure. (400X)