An Alternative Mechanism for Generation of Spherical Debris Particles on Bearing Raceway Spalls

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Spherical debris particles in spalled areas of bearing raceways have been attributed to motions of the crack faces during spall generation. This note suggests an alternative generation mechanism for the particles.

Figure 1, from Failure Atlas for Hertz Contact Machine Elements[1], shows a spherical debris particle lying on the spalled surface of a bearing raceway. The atlas characterizes the spheroids as characteristic of spalling fatigue, and attributes the spheroids to alternating micro-motions between crack faces, but qualifies by saying that the specific mechanism of their generation is not understood. The spheroid measures about 50 microns and consists of bearing steel, oxidized at the surface.

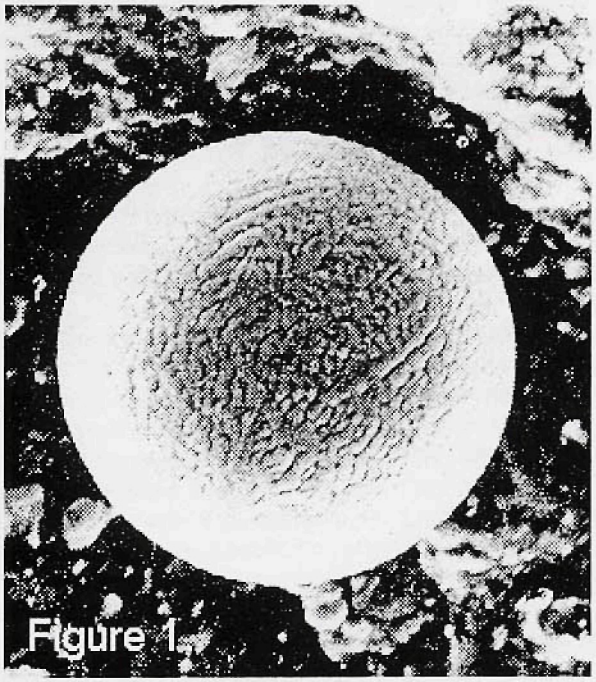

Figure 1

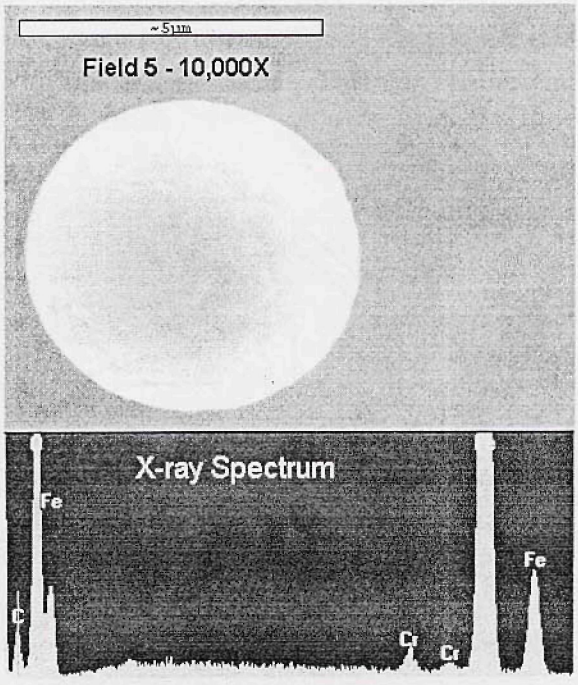

Figure 2

Preparation of bearing raceways for examination in the SEM often includes cutting the bearing rings on an abrasive cutoff wheel. Many cutoff wheels do not include water jets to cool the work-piece as the cutting proceeds. The question arises whether uncooled abrasive cutting can generate spherical debris particles.

To investigate, a technician cut the inner ring of a bearing on an un-cooled abrasive cutoff wheel. The technician cut off one piece of the ring slowly, and cut a second piece quickly. The inner ring from which the pieces derived resembled a sleeve, extending axially for about two inches away from the raceway. Both pieces originated from an area far from the raceway.

Figure 2 shows a spheroid which appeared on the surface of the quickly cut piece. Several other spheroids appeared on the piece. The spheroid measures about 5 microns. The energy dispersive x-ray spectrum below the picture suggests that the spheroid consists of oxidized bearing steel.

Scanning the surface of the slowly cut inner ring piece revealed no spheroids.

The presence of spheroids on the quickly cut inner ring piece, and their absence on the slowly cut piece, suggests that the rapid abrasive cutting produced the spheroids. The spheroids found on the quickly cut piece resemble in appearance and composition the spheroids attributed in the atlas to fatigue spalling.

The results of this short investigation emphasize the need for care in specimen preparation. Spherical debris particles arising from fast abrasive cutting could contaminate raceway specimens and give a false indication of rolling contact fatigue. ■

1. Failure Atlas for Hertz Contact Machine Elements, T.E. Tallian, ASME Press, 1992, p176.