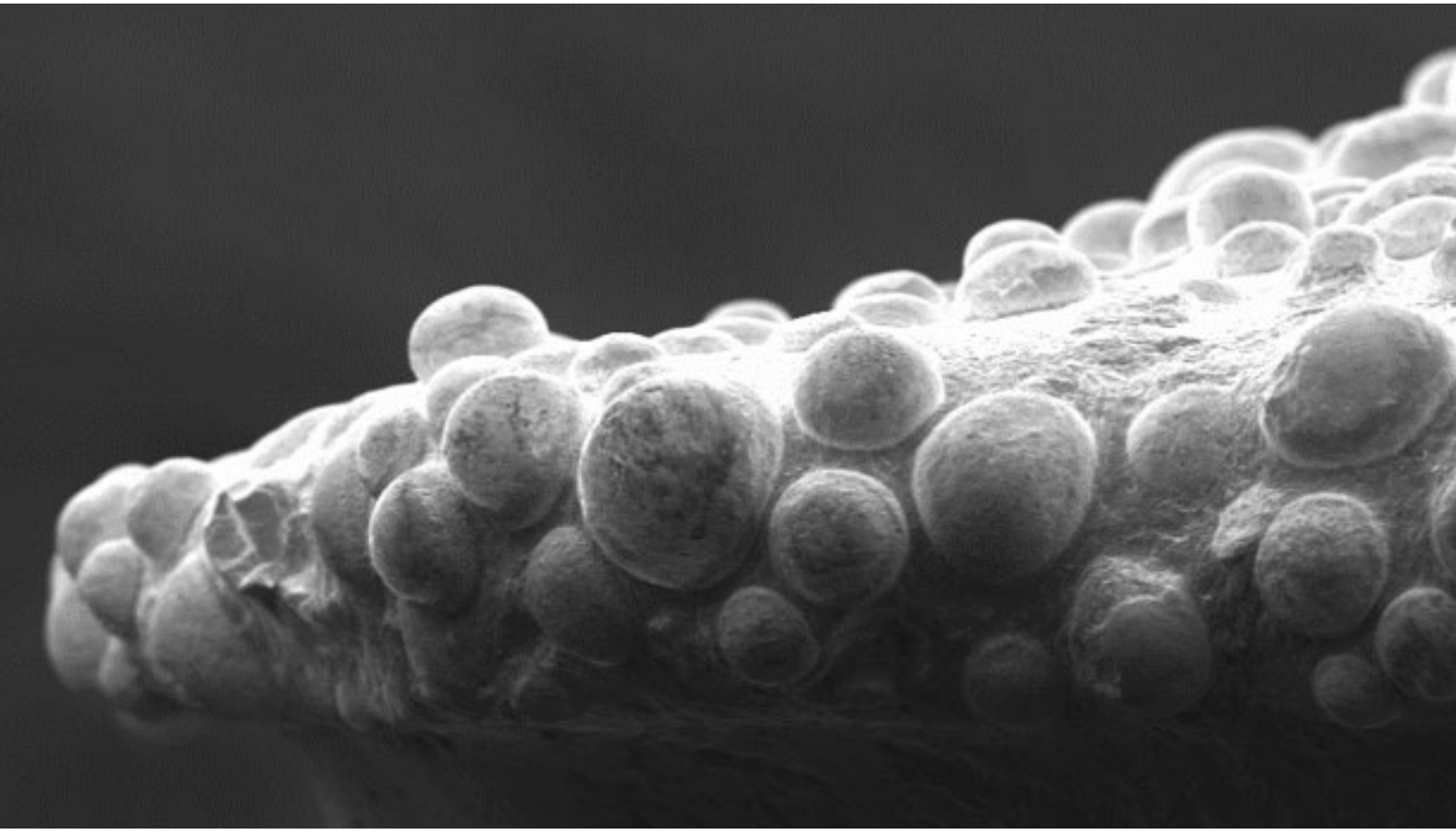
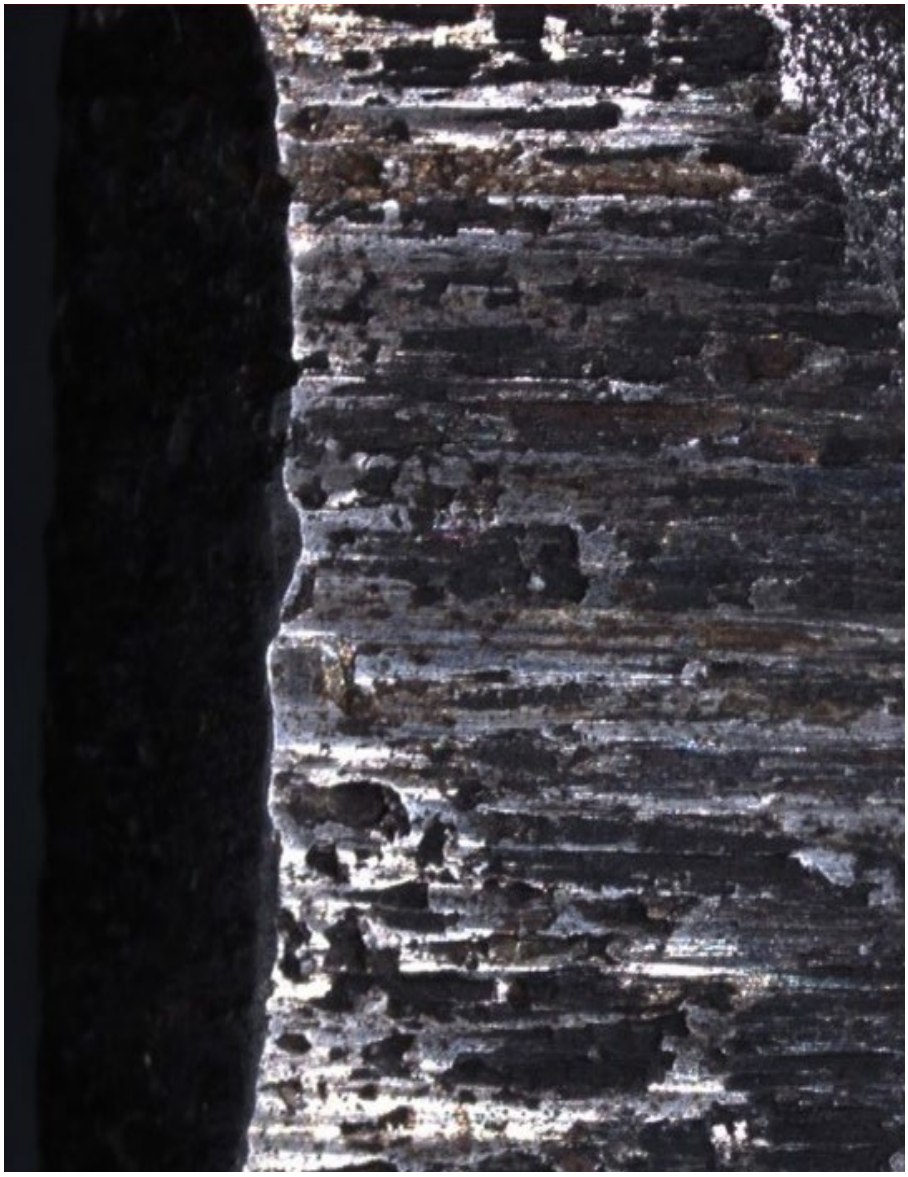
Fisher Barton



What Is Wear?

Types of Wear Processes

contents



Introduction

To understand how coatings can increase the lifespan of a part or component, one must first have an understanding of different wear processes. Wear is the gradual removal or deformation of material at solid surfaces, and it can significantly impact the performance and longevity of mechanical components. There are several types of wear, each with distinct mechanisms and effects. In many applications, more than one type of wear may be present simultaneously, complicating the challenge of mitigating wear. By comprehensively understanding these wear processes, engineers and designers can develop more effective coatings and treatments to enhance the durability and functionality of components.

TST ENGINEERED COATING SOLUTIONS
A DIVISION OF FISHER BARTON

Fisher Barton and TST

TST Engineered Coating Solutions is a division of Fisher Barton that provides over 60 years of thermal spray coating, design, and development experience. Our expertise stems from our understanding of the environment in which the coating will be used. We then design the properties required to withstand the environment to exceed the component's specific needs.

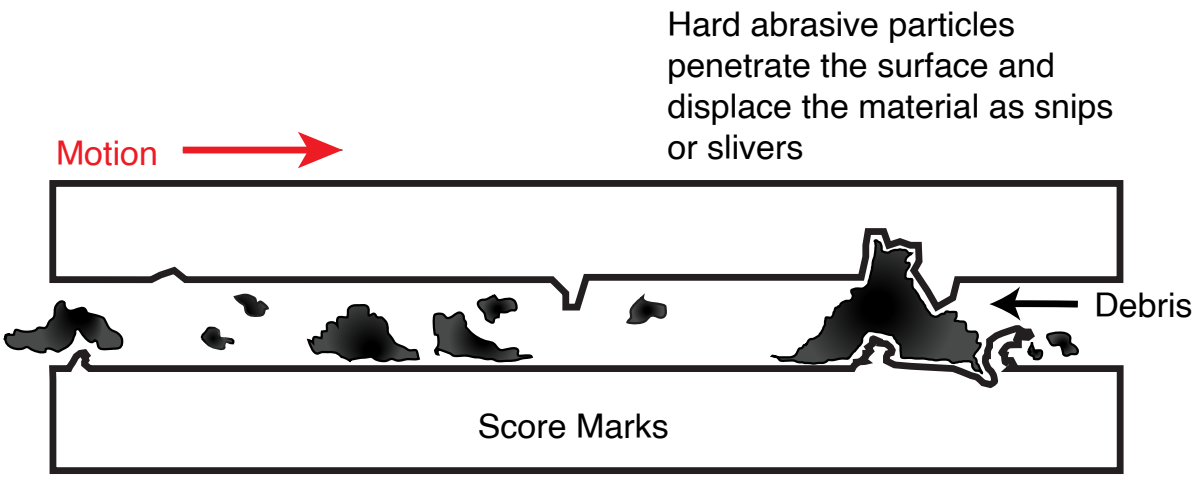
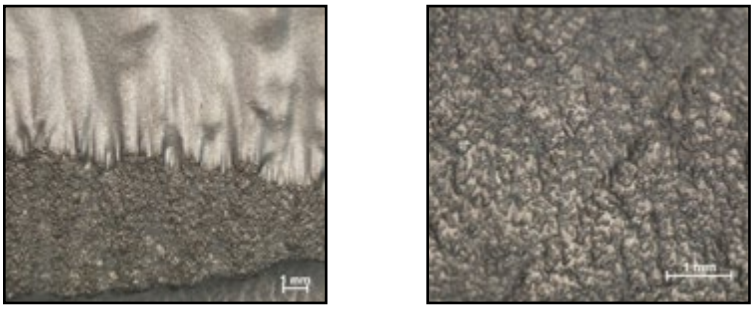


Figure 1- Abrasive Wear Diagram

1. **Abrasive Wear:** Abrasive wear is caused by interaction of a surface of asperities or hard particles which penetrate a mating surface and then gouge, scratch, or score the surface, producing debris which further degrades the surface.



Aggressive Erosion Testing

Figure 2 – Adhesive Wear Diagram

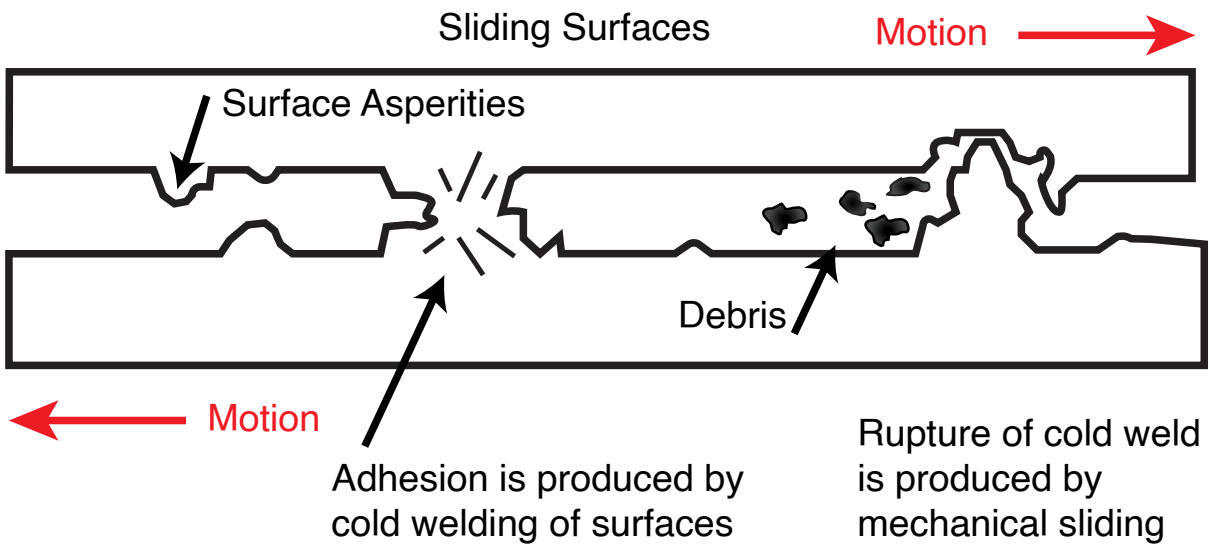
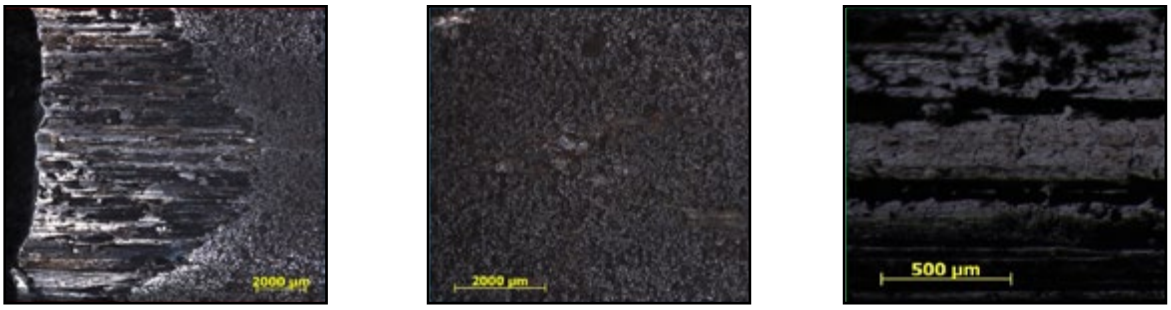


Figure 2 – Adhesive Wear Diagram

2. **Adhesive Wear:** Adhesive wear occurs when two surfaces slide against each other, and particles of the softer material are transferred onto the harder member by “cold welding” forces set up when two materials come into intimate contact. The buildup grows and eventually breaks away from the harder member. This condition usually occurs when there is little or no lubrication and is commonly called scoring or galling.



Stereoscope images of the friction between the two similar materials

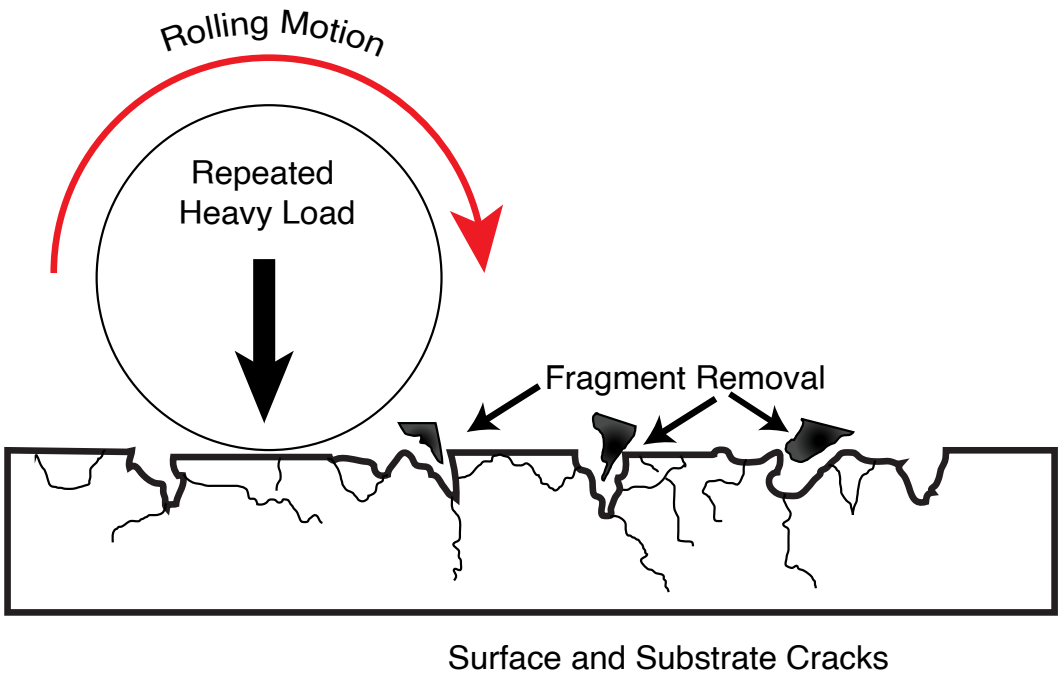
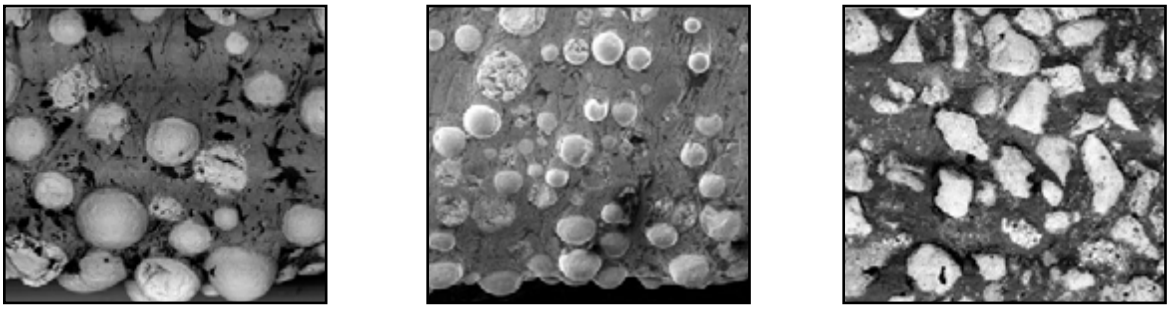


Figure 3 – Surface Fatigue Wear Diagram

3. **Surface Fatigue Wear:** Surface fatigue occurs when repeated loading and unloading set up cyclic stress that eventually forms surface or substrate cracks. This condition produces pitting on the surface and causes fragments to loosen and come off. Surface fatigue usually occurs only in environments where abrasive or adhesive wear are not present.



Abrasion Testing (Wear Scar) Samples SEM Microscope

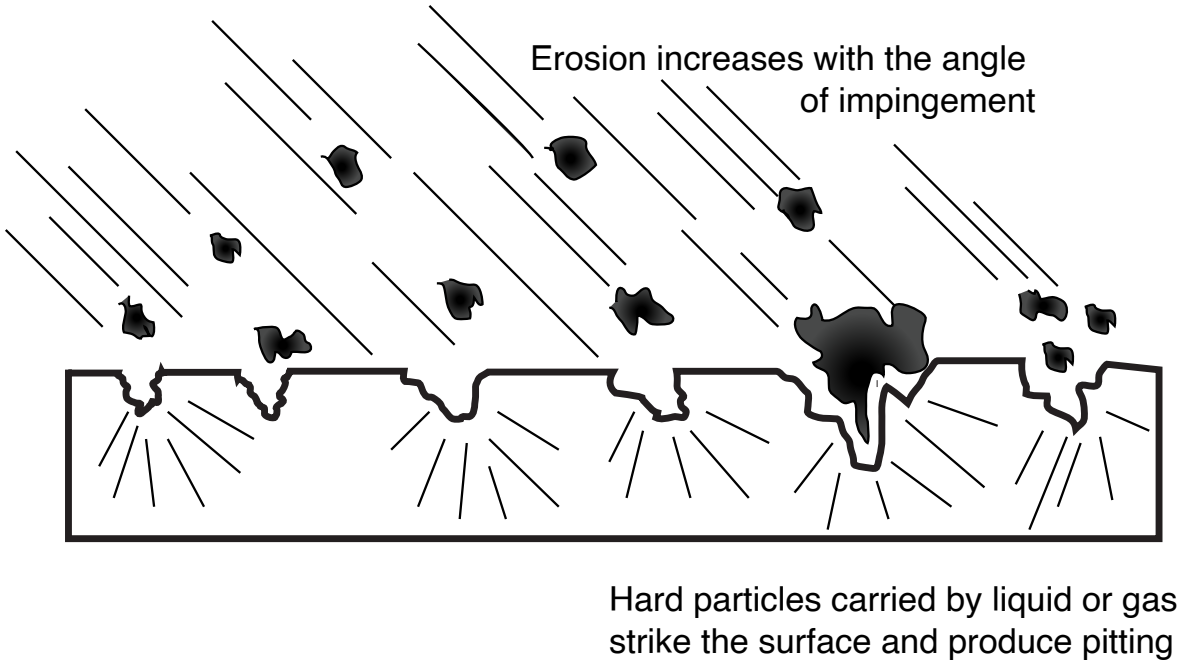
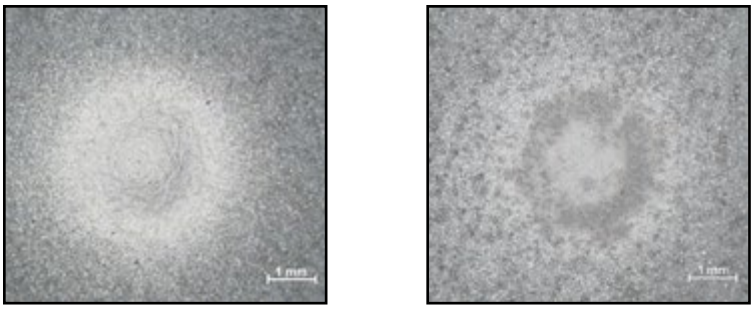


Figure 4 – Erosive Wear Diagram

4. **Erosive Wear:** Erosion is produced by sharp, hard particles carried by gas or liquid. The resulting abrasive wear increases with the velocity of the particles and the angel at which they strike the surface.



Images after ASTM G76 Erosion Test by Solid Particles Impingement

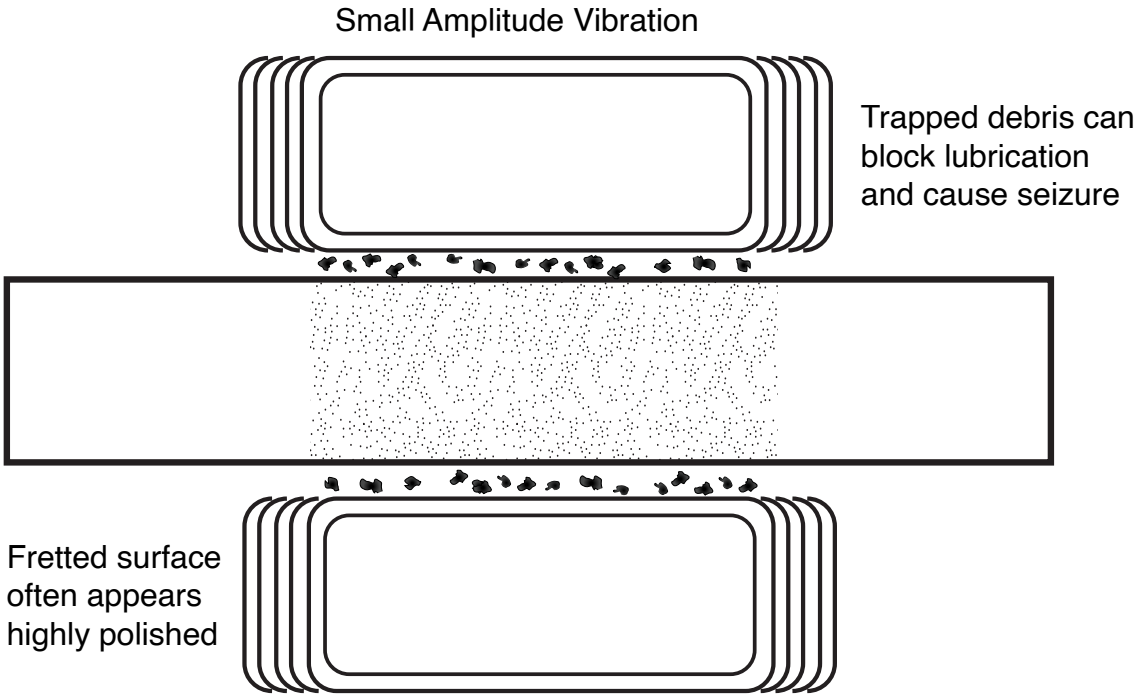
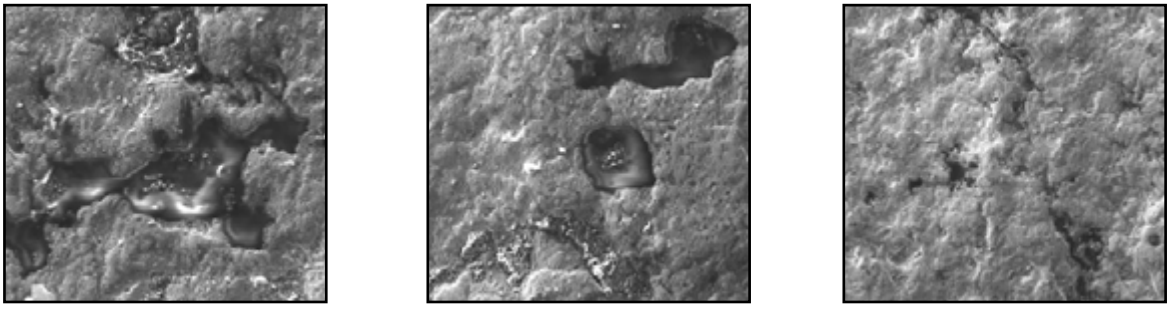


Figure 5 – Fretting Wear Diagram

5. **Fretting Wear:** Fretting is caused by vibration of other small amplitude oscillatory motion. The wear debris remains trapped between mating surfaces.



G65 Wear Scar Samples SEM Microscope

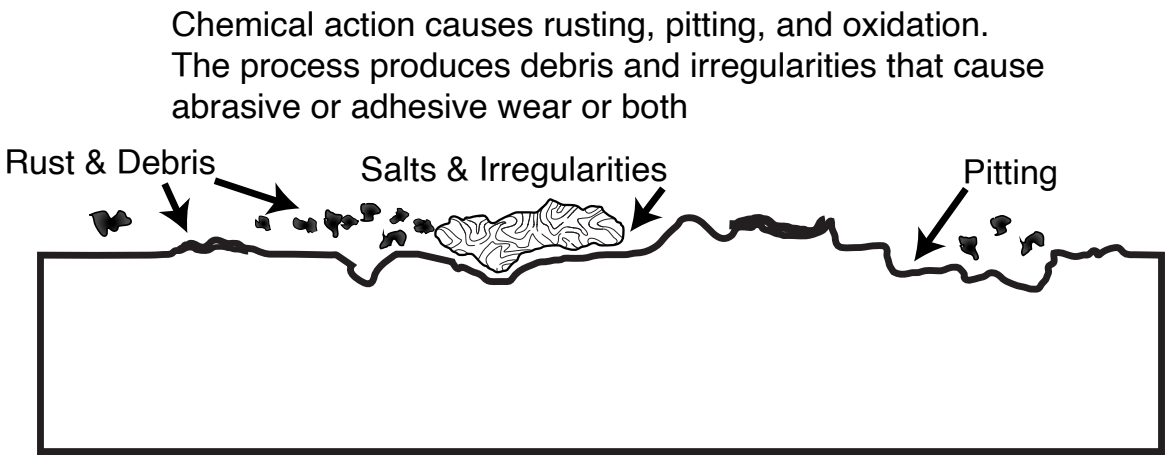
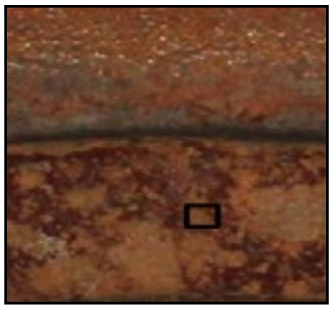
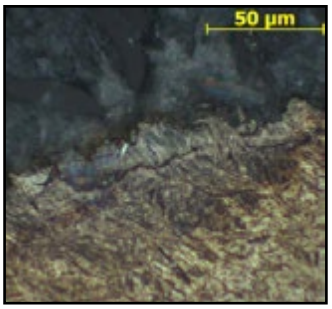


Figure 6 – Corrosive Wear Diagram

6. **Corrosive Wear:** Corrosive wea is caused by chemical action that leaves surface imperfections and debris. The resulting surface irregularities intensify abrasive wear.





Corrosive Wear viewed under a SEM microscope

Conclusion

In conclusion, understanding the various types of wear—abrasive, adhesive, surface fatigue, erosive, fretting, and corrosive—is crucial for developing effective strategies to extend the lifespan of mechanical components. Each type of wear has unique characteristics and mechanisms that contribute to material degradation. By applying appropriate coatings and treatments, it is possible to mitigate these wear processes, thereby enhancing the performance and durability of parts and components. This knowledge is essential for industries that rely on high-performance materials and seek to minimize maintenance costs and downtime. For more detailed information on wear processes and protective coatings, you can visit fisherbarton.com.

References

D. Swain, “Understanding Plasma-Sprayed Coatings”, Machine Design, March 1981. PP. 91-96