

## **What Is Wear?**

Types of Wear Processes

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## 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.

## 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.

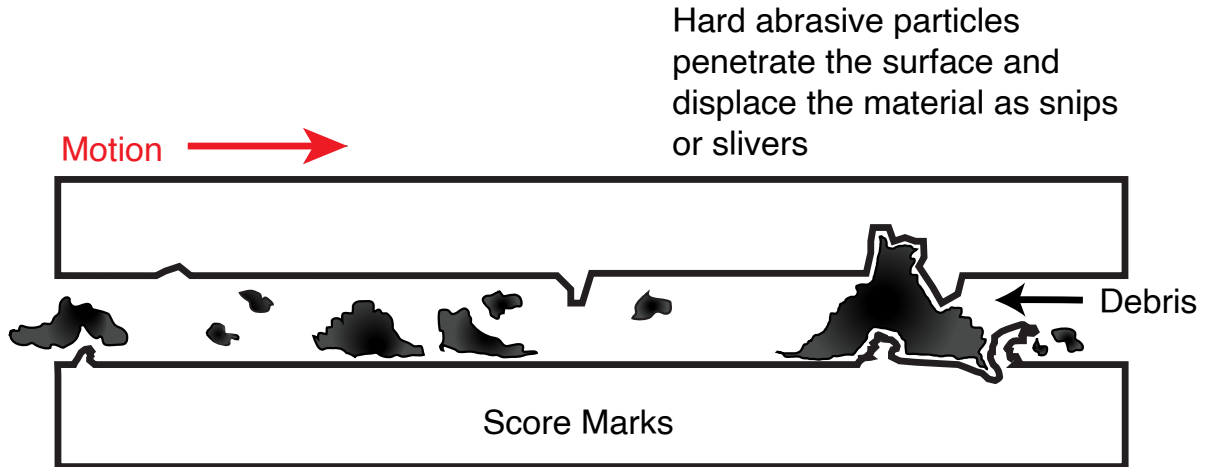
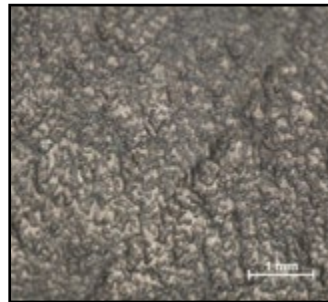
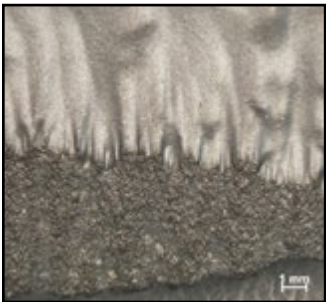


Figure 1- Abrasive Wear Diagram

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

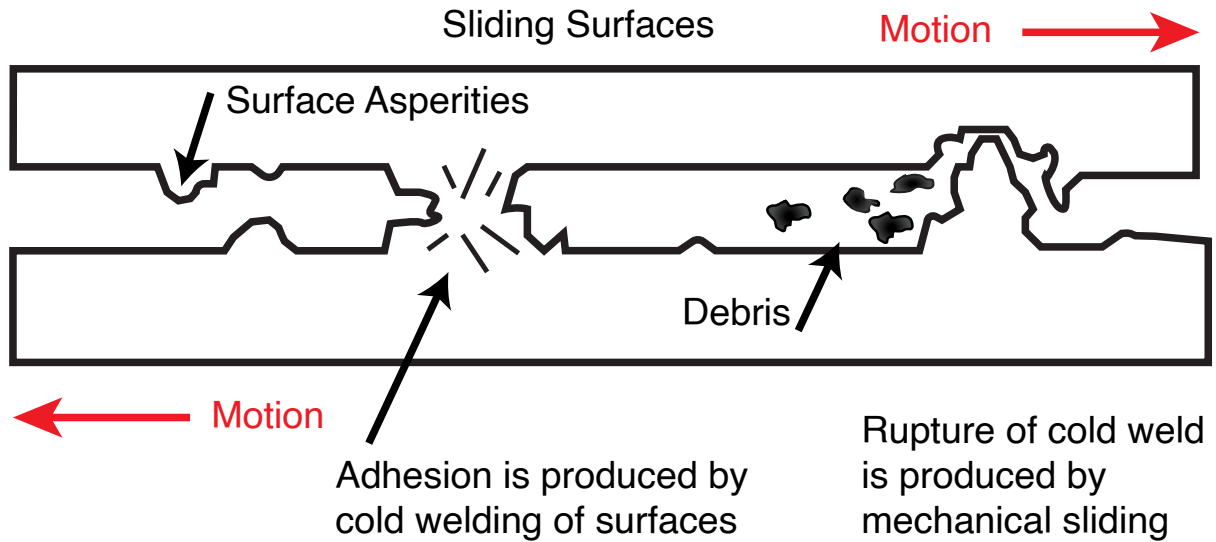
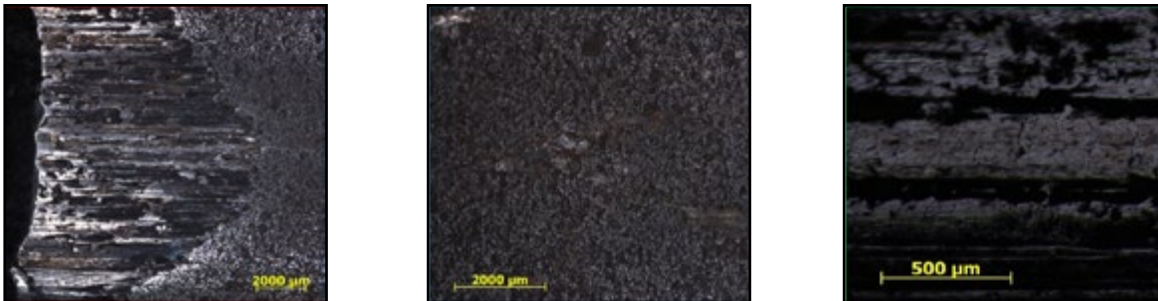


Figure 2 – Adhesive Wear Diagram

**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

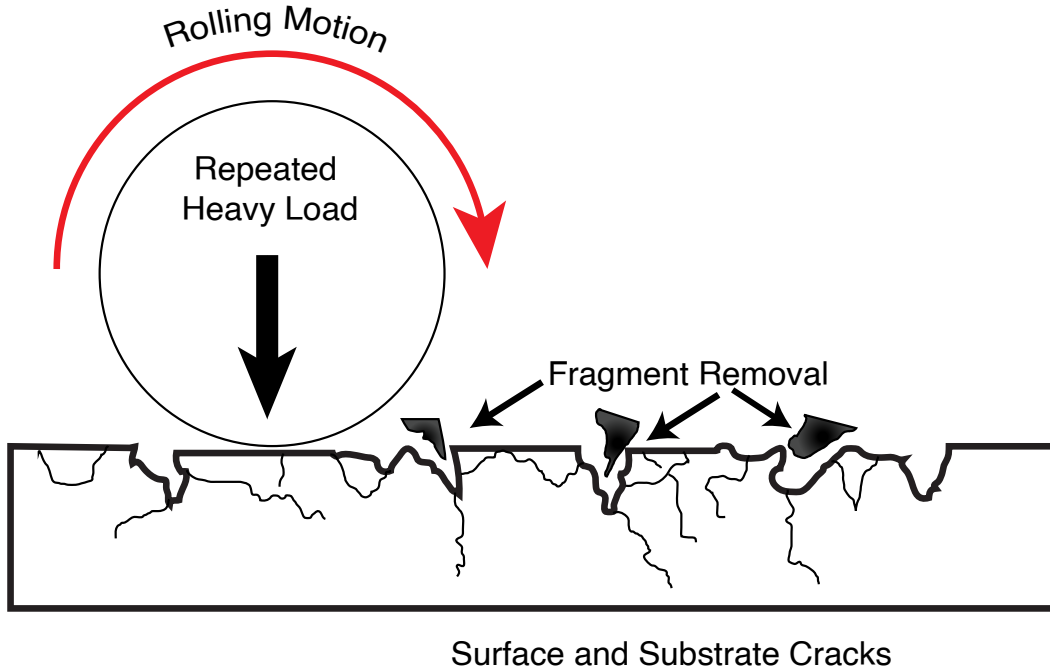
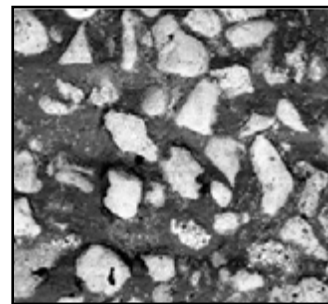
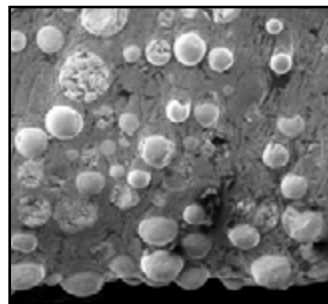
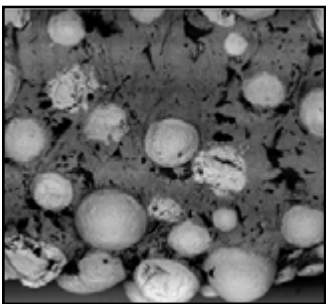
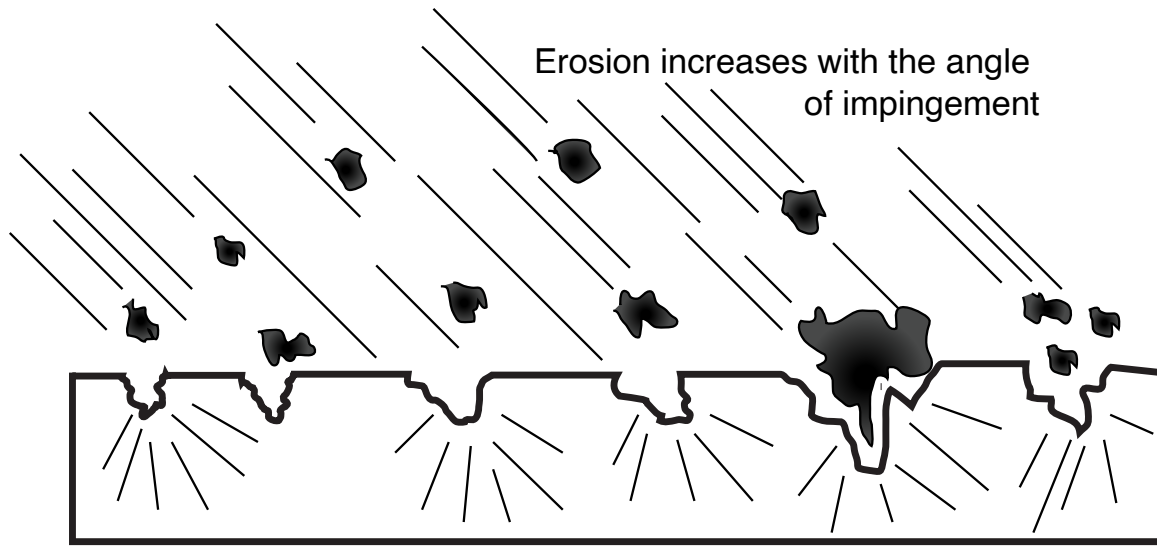


Figure 3 – Surface Fatigue Wear Diagram

**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.



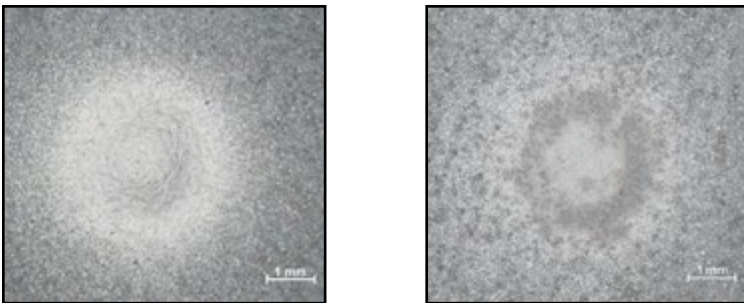
Abrasion Testing (Wear Scar) Samples SEM Microscope



Hard particles carried by liquid or gas strike the surface and produce pitting

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 angle at which they strike the surface.



Images after ASTM G76 Erosion Test by Solid Particles Impingement

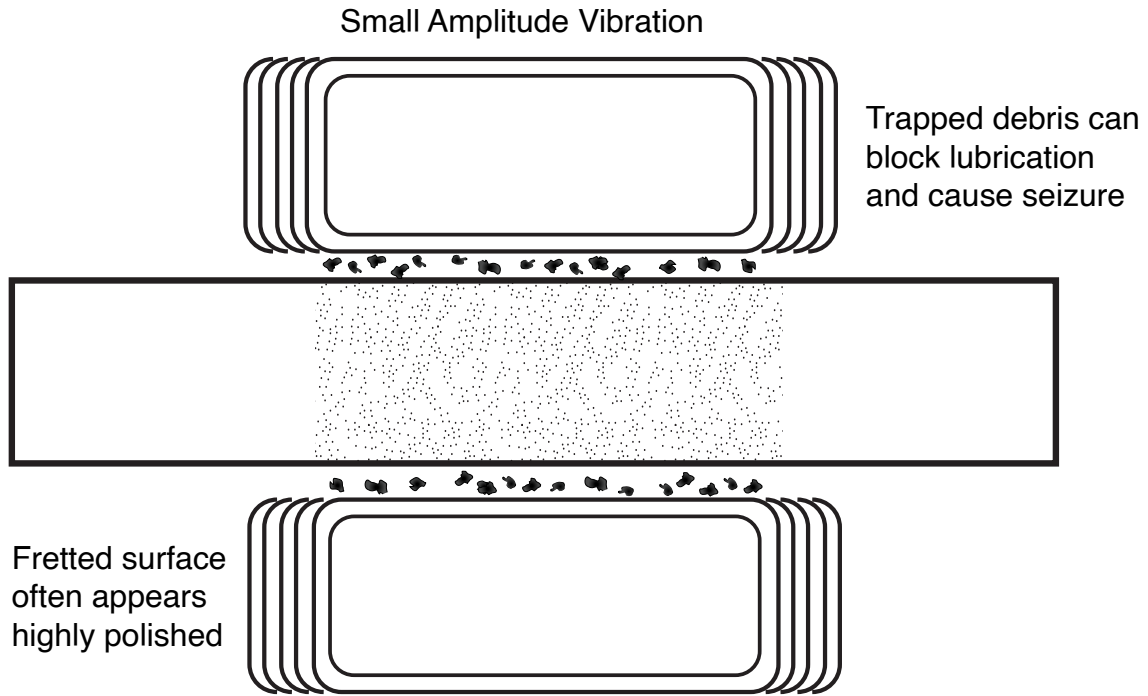
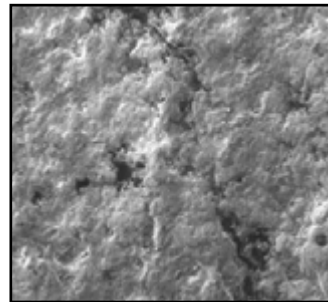
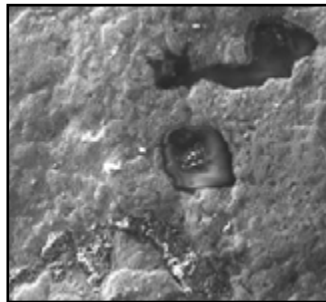
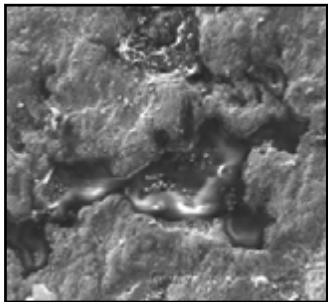


Figure 5 – Fretting Wear Diagram

**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



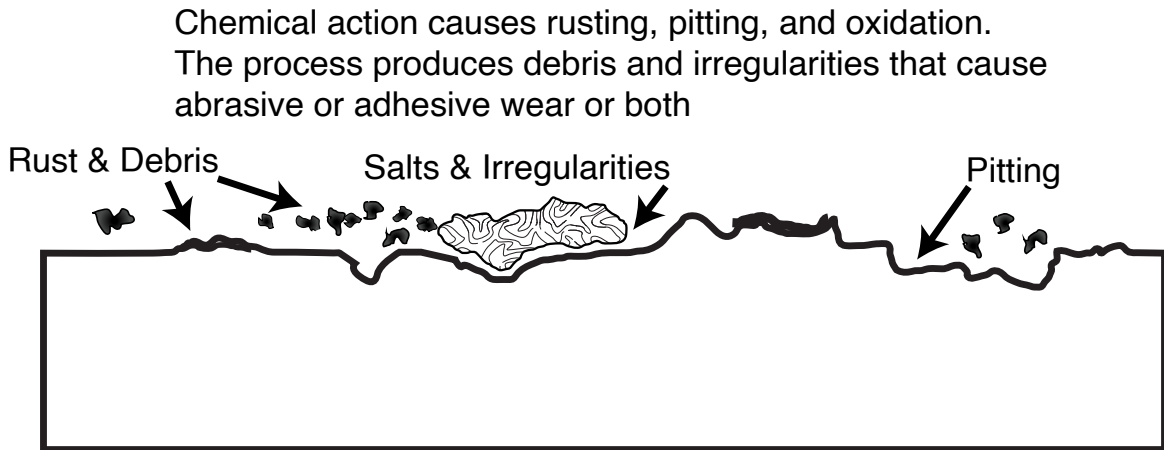
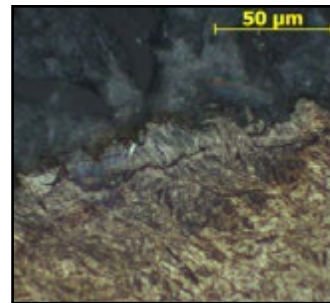
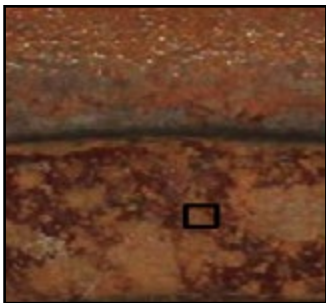


Figure 6 – Corrosive Wear Diagram

**6. Corrosive Wear:** Corrosive wear 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](http://fisherbarton.com).

## References

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

## Why Fisher Barton

Fisher Barton is a premier manufacturing innovation partner renowned for high-wear components. Our expertise is deeply rooted in the skills of our world-class talent, who are not only masters in material behavior but also develop and apply proprietary heat treating and thermal spray solutions. This transformative approach extends the lifespan of components well beyond our core manufacturing capabilities of stamping, bending, forming, cutting, welding, machining, and casting. Fisher Barton sets itself apart with a rich history of over 50+ years of manufacturing technology. Our commitment to excellence is evident in our nine locations across Wisconsin, Illinois, and Vietnam, where we continually innovate wear solutions for a variety of industries from cutting components in the turf, agriculture, recycling, and pulp and paper industries, to bronze gears, pumps, wear parts, close tolerance components, thermal barriers, and antimicrobial solutions serving the energy, food processing, transportation, and medical markets. **Fisher Barton is your partner for the highest quality solutions found —anywhere.**



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