

# Parkerizing

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**Parkerizing** (also called *phosphating* and *phosphatizing*) is a method of protecting a steel surface from corrosion and increasing its resistance to wear through the application of an electrochemical phosphate conversion coating. Parkerizing is usually considered to be an improved zinc or manganese phosphating process, and not to be an improved iron phosphating process, although some use the term *parkerizing* as a generic term for applying phosphating (or phosphatizing) coatings that does include the iron phosphating process.



A Parkerized .45 ACP pistol

Parkerizing is commonly used on firearms as a more effective alternative to bluing, which is another electrochemical conversion coating that was developed earlier.

The Parkerizing process cannot be used on non-ferrous metals such as aluminum, brass, or copper. It similarly cannot be applied to steels containing a large amount of nickel, or on stainless steel. Passivation can be used for protecting other metals.

## Application

The process involves submerging the metal part into a phosphoric acid solution whose key ingredient is often zinc or manganese, with varying additional amounts of nitrates and chlorates and copper. In one of the many processes that have been developed, the solution is heated to a temperature of 190–210 °F (88–99 °C) for a period ranging between 5 and 45 minutes. A stream of small bubbles is emitted from the metal part as the process takes place; when the bubbling stops, the process is complete. In addition to this particular processing temperature, there have also been various similar Parkerizing processes developed and patented that permit using either lower temperatures (for energy efficiency) or higher temperatures (for faster processing).

## Appearance and use

Zinc phosphating results in a non-reflective, light- to medium-gray finish. Manganese phosphating produces a medium- to dark-gray or black finish. Iron phosphating produces a black or dark gray finish similar to manganese phosphating. The grain size of the zinc phosphating is usually the smallest among the three processes, providing a more appealing cosmetic appearance in many applications. Many firearms that are Parkerized turn to a light greenish-gray color within a few years, as the coating ages, with the protective coating remaining intact. Cosmoline, especially, interacting with Parkerizing, can cause the highly-desired and attractive greenish-gray patina to develop on firearms that are stored in armories.

Manganese and iron phosphating coatings are usually the thickest electrochemical conversion coatings, being thicker than electrochemical conversion coatings such as zinc phosphating and bluing.

None of the electrochemical conversion coating finishes are painted coatings, but chemically become part and parcel of the metal surface to which they are applied.

As for all electrochemical conversion coatings, the Parkerized surface must be completely covered with a light coating of oil to maximize corrosion and wear resistance, primarily through reducing wetting action and galvanic

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action. A heavy oil coating is unnecessary and undesirable for achieving a positive grip on Parkerized metal parts.

Alternatively, the Parkerized surface may be painted over with an epoxy or molybdenum finish for added wear resistance and self-lubricating properties.

## Early history

Development of the process was started in England and continued by the Parker family in the United States. The terms *Parkerizing*, *Parkerize*, and *Parkerized* are all technically registered U.S. trademarks of Henkel Adhesives Technologies, although the terminology has largely passed into generic usage for many years. The process was first used on a large scale in the manufacture of firearms for the United States military during World War II.

The earliest work on phosphating processes was developed by British inventors William Alexander Ross, British patent 3119, in 1869, and by Thomas Watts Coslett, British patent 8667, in 1906. Coslett, of Birmingham, England, subsequently filed a patent based on this same process in America in 1907, which was granted U.S. Patent 870937 <sup>[1]</sup> in 1907. It essentially provided an iron phosphating process, using phosphoric acid.

An improved patent application for manganese phosphating based in large part on this early British iron phosphating process was filed in the US in 1912, and issued in 1913 to Frank Rupert Granville Richards as U.S. Patent 1069903 <sup>[2]</sup>.

Clark W. Parker acquired the rights to Coslett's and Richards' U.S. patents, and experimented in the family kitchen with these and other rust-resisting formulations. The ultimate result was that Clark W. Parker, along with his son Wyman C. Parker, working together, set up the Parker Rust-Proof Phosphating Company of America in 1915.

Colquhoun of the Parker Rust-Proof Phosphating Company of America then filed another improved phosphating patent application in 1919. This patent was issued in 1919 as U.S. Patent 1311319 <sup>[3]</sup>, for an improved manganese phosphating (Parkerizing) technique.

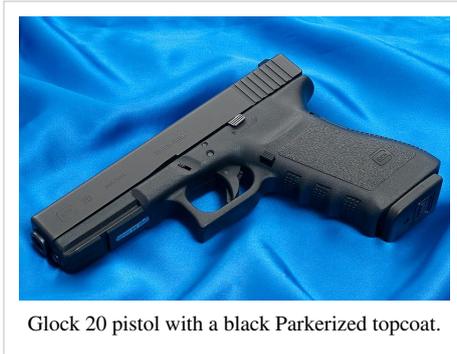
Similarly, Baker and Dingman of the Parker Rust-Proof Company filed an improved manganese phosphating (Parkerizing) process patent in 1928 that reduced the processing time to 1/3 of the original time that had been required through heating the solution to a temperature in the precisely-controlled range of 500 to 550 °F (260 to 288 °C). This patent was issued as U.S. Patent 1761186 <sup>[4]</sup> in 1930.

Manganese phosphating (Parkerizing), even with these process improvements, still required the use of expensive and difficult-to-obtain manganese compounds. Subsequently, an alternative technique was developed by the Parker Company to utilize easier-to-obtain compounds at less-expense through using zinc phosphating (Parkerizing) in place of manganese phosphating (Parkerizing). The patent for this zinc phosphating (Parkerizing) process (utilizing strategic compounds that would remain available in America during a war) was granted to inventor Romig of the American Chemical Paint Company in 1938 as U.S. Patent 2132883 <sup>[5]</sup>, just prior to the loss of easy access to manganese compounds that occurred during World War II.

Somewhat analogous to the improved manganese phosphating process improvements discovered by Baker and Dingman, a similarly-improved method was found for an improved zinc phosphating process as well. This improvement was discovered by Darsey of the Parker Rust Proof Company, who filed a patent in February 1941, which was granted in August 1942, U.S. Patent 2293716 <sup>[6]</sup>, that improved upon the zinc phosphatizing (Parkerizing) process further. He discovered that adding copper reduced the alkalinity requirement over what had been required, and that also adding a chlorate to the nitrates that were already used would additionally permit running the process at a much lower temperature in the range of 115 to 130 °F (46 to 54 °C), reducing the cost of running the process further. With these process improvements, the end result was that a low-temperature (energy-efficient) zinc phosphating (Parkerizing) process, using strategic materials which the United States had ready access to, became the most common phosphating process used during World War II to protect American war materials such as firearms and planes from rust and corrosion.

## Future

Glock Ges.m.b.H., an Austrian firearms manufacturer, uses a black Parkerizing process as a topcoat to a Tenifer process to protect the slides of the pistols they manufacture. After applying the Tenifer process, a black Parkerized finish is applied and the slide is protected even if the Parkerized finish were to wear off. Used this way, Parkerizing is thus becoming a protective and decorative finishing technique that is used over other underlying improved techniques of metal protection.



Glock 20 pistol with a black Parkerized topcoat.

Traditional iron phosphate, zinc phosphate, and manganese phosphate electrochemical conversion coatings, including Parkerizing variations, have all been criticized in recent years for introducing phosphates into surface water systems, encouraging the rapid growth of algae (eutrophication). As a result, in recent years, new, emerging technology alternatives to traditional phosphate coatings have started to see limited use, for replacing all phosphating coatings, including Parkerizing. The majority of these newer conversion coatings are fluorozirconium-based. The most popular of these fluorozirconium-based conversion coatings, introduced in 2005, incorporates the transition metal vanadium. This new, more environmentally-friendly coating is referred to as a vanadate conversion coating. Besides vanadate coatings, arsenate coatings may theoretically provide similar protection, at the risk of being a health hazard to humans and animals. It remains to be seen if these, or other new electrochemical conversion coatings, will ultimately replace traditional phosphating and Parkerizing.

Various if similar recipes for stovetop kitchen Parkerizing circulate in gun publications at times, and Parkerizing kits are sold by major gun-parts distributors such as Brownell's.

## See also

- Bluing
- Carbonitriding
- Passivation
- Phosphate minerals
- Tenifer

## References

- MIL-HDBK-205, *Phosphate & Black Oxide Coating of Ferrous Metals*: a standard overview on phosphate and black oxide (bluing) coatings
- Budinski, Kenneth G. (1988), *Surface Engineering for Wear Resistance*, Englewood Cliffs, New Jersey: Prentice Hall
- Brimi, Marjorie A. (1965), *Electrofinishing*, New York, New York: American Elsevier Publishing Company, Inc..

## External links

- Henkel Surface Technologies <sup>[7]</sup> Current owner of Parco-Lubrite (a manganese phosphating process) and other Parkerizing rust-prevention coatings. (Parco is a registered trademark of Henkel Surface Technologies.)
- Coral Chemical Company <sup>[8]</sup> Current owner of Coral Eco Treat (vanadium conversion coating process).
- Parker Rust-Proof of Cleveland <sup>[9]</sup> Last remaining of the four original job shop licensees of Parker Chemical, currently offers phosphating services.

## References

- [1] <http://www.google.com/patents?vid=870937>
  - [2] <http://www.google.com/patents?vid=1069903>
  - [3] <http://www.google.com/patents?vid=1311319>
  - [4] <http://www.google.com/patents?vid=1761186>
  - [5] <http://www.google.com/patents?vid=2132883>
  - [6] <http://www.google.com/patents?vid=2293716>
  - [7] <http://automotive.henkel.com/Products/Coatings/>
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