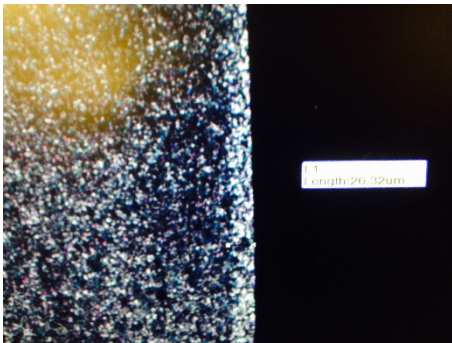




Akron Research and Technology (ART) is a research and development company based in Akron, OH. ART specialized in developing new surface engineering solutions to overcome industry limitations. Two technologies that have been developed have been aimed at allowing titanium to be used in applications not previously possible. These two solutions are ArmorTi and Anotizing.

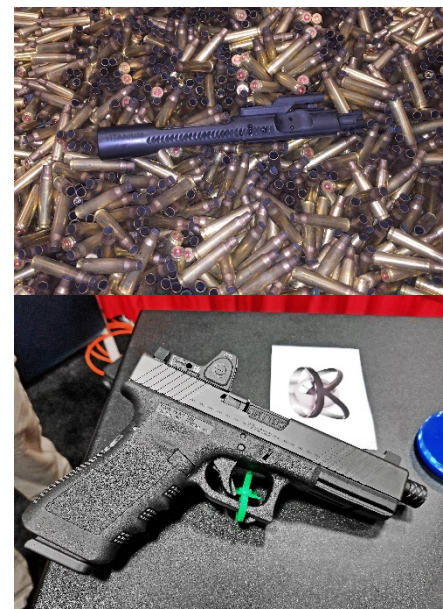
ArmorTi® is a patent pending engineered surface that provides a much need breakthrough in the use of lightweight alloys, specifically titanium. The treatment utilizes a multistage process that strengthens the base material and provides a wear resistant surface. ArmorTi® exhibits a 9 GPa (67 Rc) hardness and excellent wear resistance.



This allows for performance that has not previously been seen from lightweight alloys and gives them the ability to be used in applications that have been reserved for steel components due to its wear resistance. When tested in mixed regime sliding, ArmorTi® applied to a Ti-6-4 substrate exhibits a wear rate of $5.0 \times 10^{-6} \text{ mm}^3 / \text{J}$, while untreated specimens exhibit a wear rate of $1.0 \times 10^{-3} \text{ mm}^3/\text{J}$.

The titanium and the ArmorTi® surface both provide excellent corrosion resistance. This allows these components to be used in many harsh applications where steel components typically fail due to corrosion, such as marine environments. When tested in ASTM B-117 salt fog testing, ArmorTi treated Ti-6-4 shows no signs of corrosion after surviving 1,000 hours of exposure.

Utilization of Akron Research and Technology's ArmorTi® technology allows titanium components to be used in place of steel. This provides a wear and corrosion resistant





component that is 45% lighter than its steel counterparts. With exact solutions being tailored for each application, the result is a final product that outperforms the rest.

AnoTizing is a state of the art titanium treatment developed by ART designed to provide a black finish combined with temperature and wear resistance. AnoTizing consists of a controlled oxidation followed by a hardening process that provides high temperature resistance, hardness, and a uniform black color. Unlike PVD and CVD processes that delaminate or degrade at higher temperatures, AnoTizing is diffused into the surface of the material providing a metallurgical bond. The final result is a hard, black surface with exceptional heat resistance.

When used for suppressors and muzzle devices, titanium has been known to spark. ART's AnoTizing technology can almost eliminate spark on these devices, showing a 95% reduction in spark. This allows for the use of lighter weight silencers that can still be used in tactical situations without sparking or failure typically seen with hard anodizing or DLC. A comparison of wear rates for ArmorTi, Ti-6Al-4V, AnoTizing, and DLC coatings is shown to the right. It is clear that ART's surface technologies are unsurpassed and can enable the use of titanium in ways never before possible.

