Passivation: Is It Really Necessary for Stainless Steel Balls?

In the precision ball industry, passivation is often recommended as a final step to improve corrosion resistance of stainless steel components. However, for certain grades of stainless steel and specific manufacturing processes, the necessity of passivation is worth re-evaluating.

At our facility, we manufacture high-precision stainless steel balls, including those made from AISI 440C. This martensitic stainless steel is known for its high hardness and moderate corrosion resistance. Standard industry practices often call for post-processing passivation to remove potential free iron contamination introduced during manufacturing. Yet, our experience shows that in many cases, rigorous cleaning following polishing may already be sufficient.

After final lapping and polishing, our stainless steel balls undergo a multi-stage cleaning process that includes ultrasonic cleaning in deionized water and neutral detergents. This removes residual abrasives, machining oils, and most importantly, surface iron contamination that could lead to corrosion.

To verify the effectiveness of our process, we tested batches of 440C balls both before and after undergoing citric acid passivation per AMS-2700. We subjected these samples to 24-hour high humidity testing (per AMS-STD-753B Method 101) and copper sulfate testing (AMS-STD-753B Method 102)[1]. Both sets of samples passed the tests, showing no signs of corrosion or failure.

These results demonstrate that, for high-hardness stainless steel balls manufactured under controlled conditions, the standard cleaning and polishing process can deliver a corrosion-resistant surface equivalent to that achieved by passivation. This is especially relevant in non-critical applications or where downstream use does not justify the additional processing time and cost of passivation.

While passivation remains an important tool in the metallurgical toolbox, it is not universally necessary. For many ball grades and uses, a properly executed cleaning regimen provides sufficient protection and performance.

We continue to recommend and use passivation when required by customer specification or when field conditions dictate maximum corrosion resistance. However, our internal data shows that for 440C stainless steel balls, our post-polishing cleaning regimen can meet the same corrosion resistance benchmarks as passivated parts.

Passivation should be a choice informed by material, environment, and manufacturing quality—not simply a checkbox on a list of legacy processes. AIRCORE is dedicated to delivering value to our customers by reducing costs wherever possible. We are happy to reproduce the aforementioned tests on other materials to confirm whether or not passivation is truly necessary.

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[1] In accordance with AMS2700F, parts containing 0.85% carbon or more shall be exempt from this test. AIRCORE performed the test at the request of a customer.