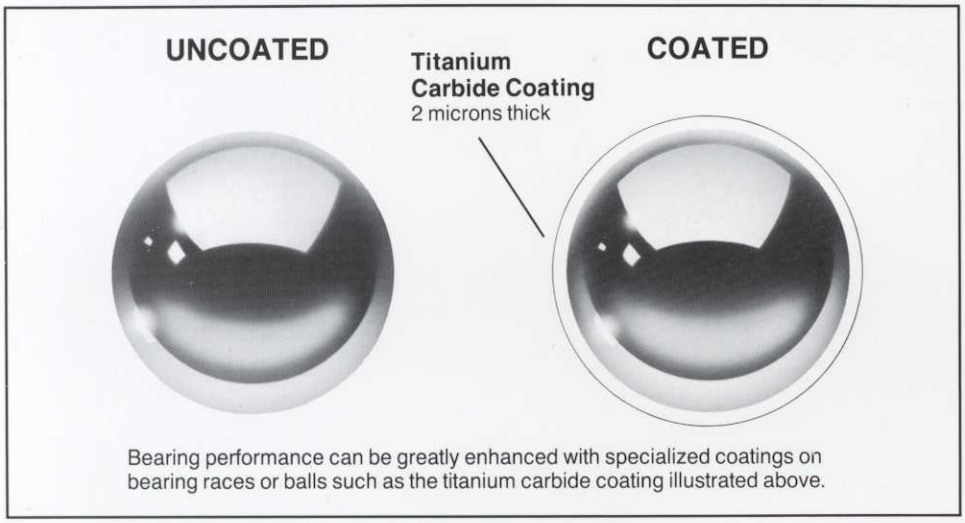
A BARDEN

Precision Bulletin

Number 3



Bearing performance can be greatly enhanced with specialized coatings on bearing races or balls such as the titanium carbide coating illustrated above.

Coatings for Balls and Bearing Surfaces

Coatings and other forms of surface modification can play an important role in a variety of ball bearing applications. Typical coating methods include electroplating, sputtering, chemical vapor deposition (CVD), physical vapor deposition (PVD) and ion plating. All of these methods may be used to control wear, to increase lubrication or to control corrosion. Each modification, however, must be used within defined limits, since coatings can be helpful or harmful depending on the end-use or application.

Chromium Coatings Often called "hard chrome," chromium coatings are produced by electroplating. This kind of coating resists galling, reduces friction and can provide protection from corrosion. In fact, because they are strongly adherent and very tough, chromium coatings are frequently used in corrosive environments to protect the metal bearing surfaces. Depending on the ultimate use of the part, chromium coatings may require polishing or refinishing when applied to a bearing raceway.

Sputtering This process produces a thin adherent film in an ion-charged environment. Sputtering can be used to deposit metals, plastics and some lubricants on bearing parts. Because the film is produced by energy generated when the material makes impact with the sputtered surface, very little subsurface alteration occurs. This means that sputtered surfaces do not require subsequent burnishing or polishing. The coating produced by sputtering is only physically bonded to the substrate, however, and may crack or break under conditions of high bearing stress or load.

Ion Plating Ion plating uses a form of electroplating, combined with thermal evaporation and ion impingement, to create a strong, metallurgically-bonded adherent surface. Tungsten carbide, titanium carbide and titanium nitride are frequently deposited using this method. Recently, the successful plating of bearing balls with titanium carbide (TiC) coatings has resulted in increased bearing life, reduced friction and wear and decreased deterioration of bearing lubricant. When applied to a substrate of stainless steel, ion plated coatings of titanium carbide are strongly adherent, very hard and resistant to corrosive attack.

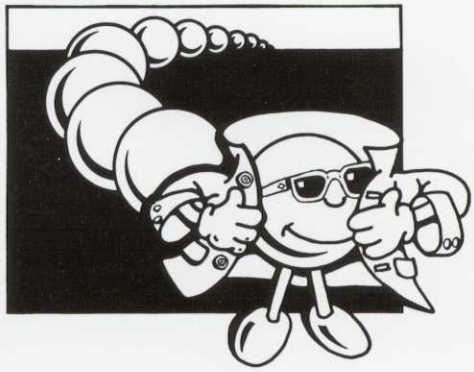
Two systems are used for ion plating: Chemical Vapor Deposition (CVD) and Physical Vapor Deposition (PVD). The temperatures reached and the method of coating vary with the two systems. Both CVD and PVD produce high temperatures which reduce the ability to coat large or complex objects without distortion. In fact, reheat treatment of hardened parts is always necessary. The processes are very effective with smaller parts, however. Ion plated coatings of TiC using the CVD process have proven very successful on balls smaller than one-quarter inch in size.

Ion Implantation While not strictly a coating or film forming process, ion implantation is of interest in ball bearing applications for several reasons. The process was originally developed in the production of semi-conductors, and is now used to selectively increase corrosion resistance, hardness, wear resistance and other surface-sensitive properties of metals. Ion implantation does not affect part dimensions, and since material penetration is small, the process has little effect on subsurface properties. In application, however, heavy loads may negate or totally destroy the advantages of ion implantation.

Solid Lubricant Coatings Solid lubricants can be bonded, formed, sprayed, dipped, tumbled, burnished or sputtered on bearing surfaces. Sputtering frequently involves the use of molybdenum disulfide, selenides or graphitic compounds. The laminar composition of these materials enhances lubrication — they literally slip over one another as mating surfaces are moved.

The choice of lubricant, as well as the method of application, determine the strength of the bond to the base material. Dipped or sprayed films, for example, will support load stresses of up to 100,000 psi, while thermally-bonded films can typically support load stresses of as much as 225,000 psi.

If you have a bearing application which you feel would benefit from one or more of these coating technologies, please contact us. We'd be happy to discuss and evaluate your application, as well as offer advice on how protective or lubricating coatings can enhance bearing performance for you. Just contact your Barden Sales Engineer or your Barden Application Engineer.



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