THERMAL COATINGS

METHODS OF APPLICATIONS

BY: DAVID M. THOMPSON

We offer the following information to assist you in the selection of thermal coating and their application in relation to your needs. This is based on experience with these coatings in various applications in the paper, power, oil, chemical, and marine industries for the past 25 years.

First, we try to determine what kind of coating will best serve the need. There are four basic families of hard coated materials. They are: Ceramics, tungsten carbides, cobalt base alloys, and Nickel-Chrome Boron (NCB) alloys. We have evaluated all of these materials and though all are advantageous to base materials; we have determined NCB coating will perform best in most applications in the industries that we serve.

Second, we try to determine what method of application best serves the need. The methods we are familiar with are: basic metalizing, plasma spray, HVOF and the fusing method. All methods have their places and can be advantageous. In selection of coatings and method of application one should keep in mind two things: mechanical bonded or metallurgical bond coating (or fused coating). It is my opinion that metallurgical bonded coating should always be considered first when choosing a method. Fused coatings, especially NCB coating, substantially improves the corrosion and abrasive resistance. This is a dense, porous-free, metallurgical bonded coating that will not chip, crack, or spall off and has very low co-efficient of friction. Fused coatings are also recommended for shrink fits because the coating is adhered to the substrate metallurgically. When applying heat to the part the fused coating will not crack

or pop off. Fused coatings are usually heated to 1900˚ F to 2100˚ F to allow bonding to the substrate and are mostly applied to round or cylindrical parts such as shafts and sleeves. Stainless steel and carbon steel tubing with a 1-1/2” wall thickness has been successfully fused up to 36” OD. So based on bond strength, porous-free coating, coating depth and 6-8 RMS grind finish, fused coating should have first consideration.

When metallurgical bond coatings cannot be considered, all that is left in thermal coatings are mechanical bonded coating. Some amazing things have happened to the mechanical bonded coatings in the last few years and the High Velocity Oxy Fuel System of HVOF has led the way. All though this system delivers a mechanical bonded coating, it is my opinion that it is at the head of the class. HVOF delivers dense porous-free coating (rivals fused coating) that resists cracking, chipping, or spalling. HVOF systems can deliver coating to 12,000 to 15,000 PSI bond strength. The best advantages of HVOF is that it will deliver exotic coatings (Hastalloy, Nickel, tungsten carbide, etc.) to parts that have been finished machined and can do so without any distortion. Expamle: new impellers and pump cases. It is also the best method for coating irregular shapes and flats.

The least recommended in the methods of applications are called basic metalizing, or cold spray. Basic metalizing has its place, but because these coatings are usually porous and do not have good bond strength (usually 5,000 to 6,000 PSI), I do not usually recommend. Probably the most economical way of delivering coating to a substrate, but usually has the most failure. Due to

porosity and bond strength, chemicals can attach and destroy the coating. Sealants are used and are somewhat helpful, but not enough to risk on an expensive and complicated piece of rotating equipment. Most cold spray coating are porous, mechanically bonded, and are fragile, and the corrosive media being handled can penetrate the coating, attack the base metal, loosen the bond and cause the coating to fall off. It has been my experience cold spray coatings have an extremely low coefficient of expansion and when subjected to elevated temperatures from material being pumped or loss of cooling water or excessive tightening of the packing gland the base material will expand while the coating does not. Thus allowing the coating to fail. Cold spray coatings can also be destroyed by various mechanical means, excessive vibration in the equipment, extreme heat or cold temperature of product, or even atmospheric temperatures, and sometimes, even careless handling. Applications error is another common reason for cold spray failure and extreme caution should be used to insure proper application. When failure occurs, they are catastrophic in nature and customers should carefully consider the application when using cold spray methods of application.

To sum it up there are a few basic things to remember, when manufacturing new parts fused coating should be considered first. When repairing parts that could be destroyed or warped or bent from to much heat; HVOF should then be considered. HVOF method can also deliver many more exotic coating than the fused coating method. There are still many applications for cold spray coating, but like I previously stated, please use caution.