

## 2. INTRODUCTION TO CERMET COATINGS

### *a. Cermet coatings*

The name CERMET is derived from CERAmic-METAllic and these are composite coatings that have ceramic particles in a metal matrix, analogous to re-bar in a cement matrix or carbon fiber in a resin matrix etc... These coatings are used in many industries for their superior wear (and high temperature wear) resistance, corrosion resistance and frictional properties.

There are many different types of cermet and also many different grades within the different types. The cermet A coating that we use on our rotor housings and cast iron plates is today's evolution of the exact coating that was used in the 1991 LeMans winning 787B racecar. Although cermet coatings have been around since the mid 1960's, the coatings have evolved greatly over the past 15 years. Today's coatings are superior in all



aspects including cost, bond strength, reduced friction as well as corrosion and wear resistance. The coating and process we use is widely used in aerospace applications but we modify the coating ingredients and application process. The resulting coating has greatly reduced internal stresses, higher bond strength and reduced friction to the coatings that were used in highly successful racing rotary engines 15 years ago.

A new application for thermally sprayed cermet coatings is as replacements for hard chrome plating. Hard chrome plating can produce a wear resistant coating with good surface finish at cost effective price. However, there are growing environmental concerns associated with the disposal of the effluents from the used plating solution and these concerns have caused the cost of the process to increase.

Cermet coatings have a wear resistance which is between two and a half and five times better than hard chrome plating and do not suffer from effluent disposal problems. They are therefore finding increasing use at the expense of hard chrome plating, particularly if wear resistance is important or if a thick coating is required on a large part.

Some technical specifications and comparisons:

<b>application chart</b>				
	<b>re-ground chrome</b>	<b>Cermet B</b>	<b>Cermet A</b>	<b>Cermet X</b>
<b>stock engine</b>	<b>good</b>	<b>better</b>	<b>best</b>	<b>Ultimate</b>
<b>performance street</b>	<b>good</b>	<b>better</b>	<b>best</b>	<b>Ultimate</b>
<b>novice racing</b>	<b>good</b>	<b>better</b>	<b>best</b>	<b>Ultimate</b>
<b>professional racing</b>	<b>not recommended</b>	<b>good</b>	<b>better</b>	<b>Ultimate</b>
<b>aviation</b>	<b>not recommended</b>	<b>good</b>	<b>better</b>	<b>best</b>
<b>power generation</b>	<b>not recommended</b>	<b>good</b>	<b>better</b>	<b>best</b>
<b>alternative fuels</b>	<b>not recommended</b>	<b>good</b>	<b>better</b>	<b>best</b>
<b>apex seal compatibility</b>				
<b>Cermamic</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Carbon</b>	<b>X</b>	<b>X</b>	<b>not recommended</b>	
<b>Hard ferrous &gt;60 Rc</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Soft ferrous &lt;60Rc</b>	<b>not recommended</b>	<b>X</b>	<b>not recommended</b>	
<b>Mazda OEM</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>attributes</b>				
<b>oil retention</b>	<b>poor</b>	<b>oleophilic</b>	<b>oleophilic</b>	<b>oleophilic</b>
<b>Hardness- Macro</b>	<b>68-72 Rc</b>	<b>47</b>	<b>50</b>	<b>58</b>
<b>Hardness- Micro</b>	<b>1000 Hv</b>	<b>2800 Hv</b>	<b>1800 Hv</b>	<b>2400 Hv</b>
<b>friction</b>	<b>0.4</b>	<b>0.2-0.3</b>	<b>0.2</b>	<b>0.1</b>
<b>wear resistance</b>	<b>fair</b>	<b>very good</b>	<b>excellent</b>	<b>ultimate</b>
<b>bond strength</b>	<b>&gt;12000 psi</b>	<b>&gt;12000 psi</b>	<b>&gt;12000 psi</b>	<b>&gt;12000 psi</b>