



THERMALLY-SPRAY COATED SPECIMENS

Thermally sprayed coatings (TSC) and thermal barrier coatings (TBC) are widely used on many metal substrates. Invariably, these coatings are not 100% dense but contain several types of voids, such as porosity and linear detachments. Hot compression mounting is not recommended as the molding pressure can collapse the voids. Use a low-viscosity castable epoxy and use vacuum infiltration to fill the connected voids with epoxy. Fluorescent dyes may be added to the epoxy. When viewed with fluorescent illumination, the epoxy-filled voids

appear bright yellow-green. This makes it easy to discriminate between dark holes and dark oxides, as would be seen with bright field illumination. Filling the pores with epoxy also makes it easier to keep the pore walls flat to the edge during preparation. Aside from this mounting requirement, TSC and TBC specimens are prepared using all of the factors needed for good edge retention (see pages 14-17). A variety of procedures can be used. The Apex Hercules H rigid grinding disc produces exceptional edge flatness for these specimens. Two four step procedures for TSC and TBC specimens using the Apex Hercules H rigid grinding disc for specimens with metallic coatings and one procedure

Table 30: 4-Step Method for TSC and TBC Specimens with Metallic Coatings

Sectioning	Precision Saw with 15HC blade recommend for thermal spray coatings				
Mounting	Castable, typically with epoxy drawn under vacuum				
Surface	Abrasive / Size	Load - lbs [N] / Specimen	Base Speed [rpm]	Relative Rotation	Time [min:sec]
Apex Color Yellow	35µm Diamond water cooled	6 [27]	300		Until Plane
Apex Hercules S Rigid Grinding Disc	9µm MetaDi Supreme Diamond*	6 [27]	150		4:00
TriDent	3µm MetaDi Supreme Diamond*	6 [27]	150		3:00
ChemoMet	0.02 - 0.06µm MasterMet Colloidal Silica	4 [18]	150		2:00
= Platen = Specimen Holder *Plus MetaDi Fluid Extender as desired					
Imaging & Analysis	Porosity Assessment, Coating Layer Thickness, Particle Sizing, Phase Area Percent				
Hardness Testing	Vickers, Knoop				

Table 31: Alternate 4-Step Method for TSC and TBC Specimens with Metallic Coatings

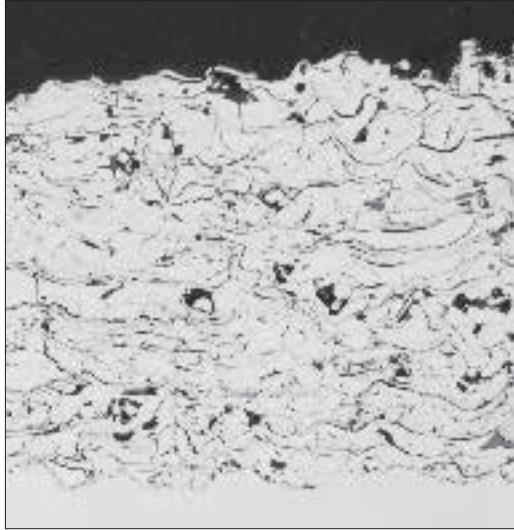
Sectioning	Precision Saw with 15HC blade recommend for thermal spray coatings				
Mounting	Castable, typically with epoxy drawn under vacuum				
Surface	Abrasive / Size	Load - lbs [N] / Specimen	Base Speed [rpm]	Relative Rotation	Time [min:sec]
Apex Hercules H Rigid Grinding Disc	30µm Diamond water cooled	6 [27]	300		Until Plane
UltraPad	9µm MetaDi Supreme Diamond*	6 [27]	150		4:00
TriDent	3µm MetaDi Supreme Diamond*	6 [27]	150		3:00
ChemoMet	0.02 - 0.06µm MasterMet Colloidal Silica	4 [18]	150		2:00
= Platen = Specimen Holder *Plus MetaDi Fluid Extender as desired					
Imaging & Analysis	Porosity Assessment, Coating Layer Thickness, Particle Sizing, Phase Area Percent				
Hardness Testing	Vickers, Knoop				



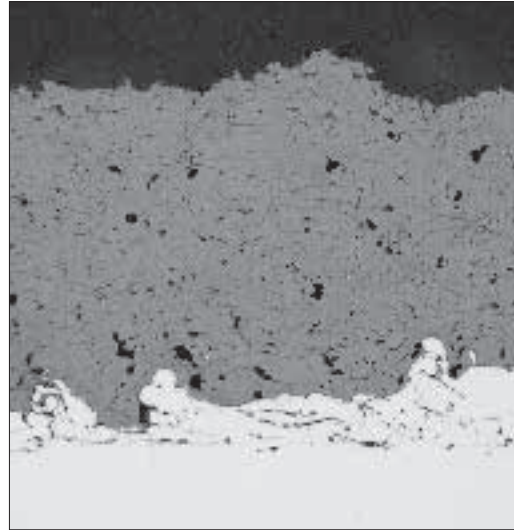
Thermally Spray Coated Specimens

for specimens with ceramic coatings are given, see Tables 30-32.

The 30 μ m resin bonded, or the 45 μ m metal bonded UltraPrep diamond discs, can be substituted for the planar grinding step. (Table 30 and 31). UltraPol or UltraPad cloths can be used in the second step. (Table 30 and 32).



NiCrAlY thermally-spray coated steel specimen revealing a small amount of porosity (black spots), linear detachments (elongated black lines), and inclusions (gray particles) (unetched, 100X).



Microstructure of a steel substrate covered by two thermally-sprayed layers, a NiAl bond coat and yttria-zirconia top coat (unetched, 100X). The bond coat contains pores, linear detachments and inclusions while the top coat is quite porous.

Table 32: 4-Step Method for Ceramic Thermal Spray Coatings

Sectioning	Precision Saw with 15HC blade recommend for thermal spray coatings				
Mounting	Castable, typically with epoxy drawn under vacuum				
Surface	Abrasive / Size	Load - lbs [N] / Specimen	Base Speed [rpm]	Relative Rotation	Time [min:sec]
Apex Color Red	75 μ m Diamond water cooled	5 [22]	300		Until Plane
Apex Hercules S Rigid Grinding Disc	9 μ m MetaDi Supreme Diamond*	5 [22]	150		4:00
TriDent	3 μ m MetaDi Supreme Diamond*	6 [27]	150		3:00
ChemoMet	0.02 - 0.06 μ m MasterMet Colloidal Silica	6 [27]	150		2:00
= Platen = Specimen Holder *Plus MetaDi Fluid Extender as desired					
Imaging & Analysis	Porosity Assessment, Coating Layer Thickness, Particle Sizing, Phase Area Percent				
Hardness Testing	Vickers, Knoop				