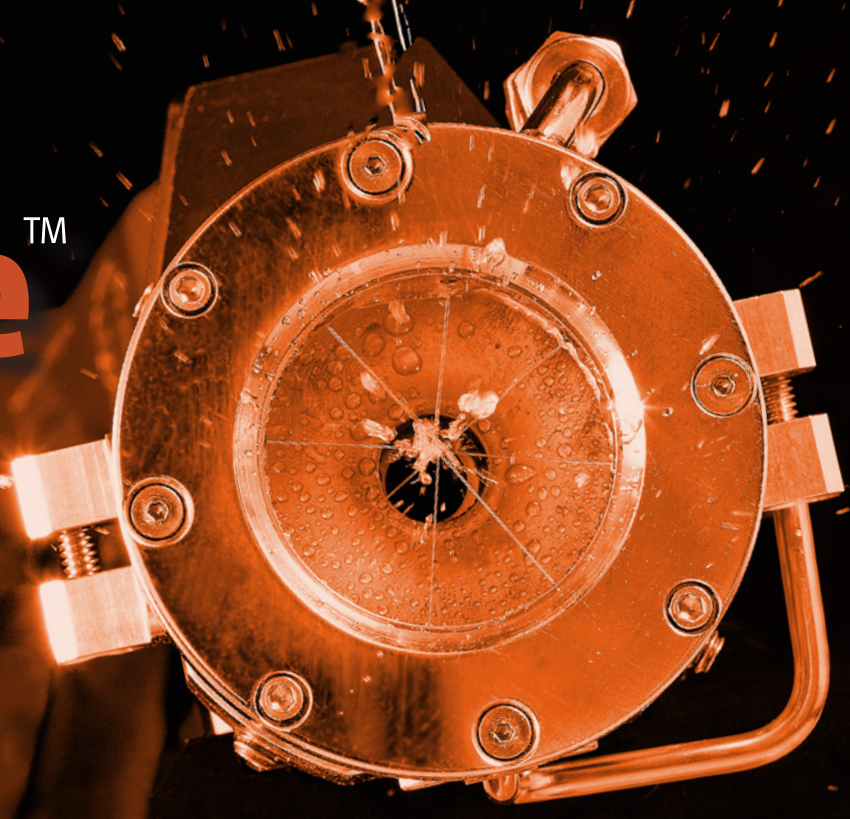


LiquiEdge™



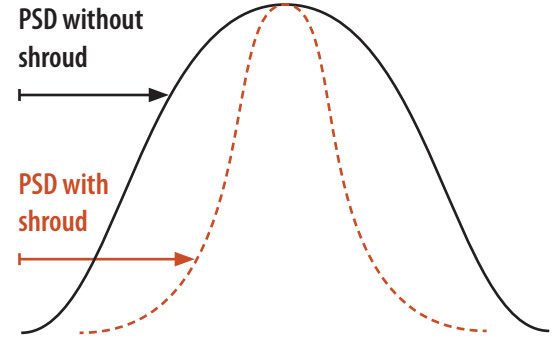
Smother, denser coatings and targeted deposition

All atmospheric thermal spray processes have overspray problems due to particles that do not deposit with acceptable properties. These unwanted particles are mostly located along the outer boundary of the plume.

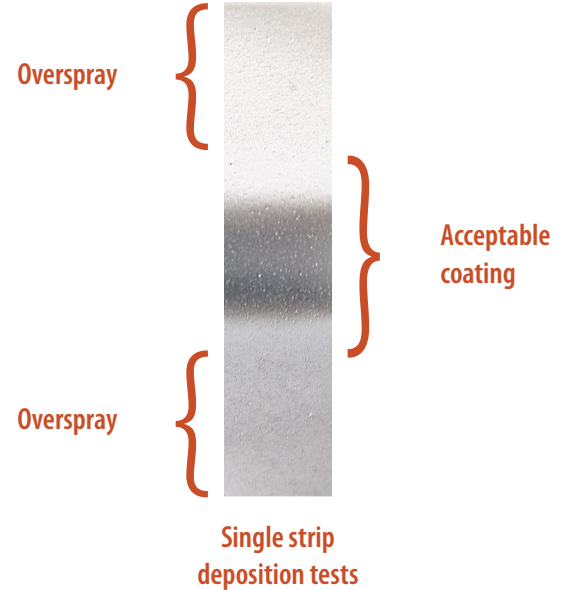
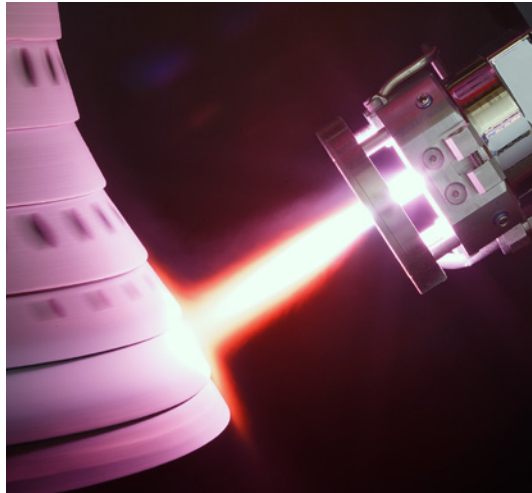
The **Progressive LiquiEdge™** shroud combats these unwanted particles by injecting water into the plume boundary. This shroud of water around the plume core deflects unwanted particles, reduces unwanted particle adhesion, and impacts on the substrate to remove overspray particles that have settled on the surface. Through this combination of benefits the patented **LiquiEdge™** can be used to produce denser, smoother coatings and provide better control of where coating is deposited.

Plume diameter and particle size distribution control

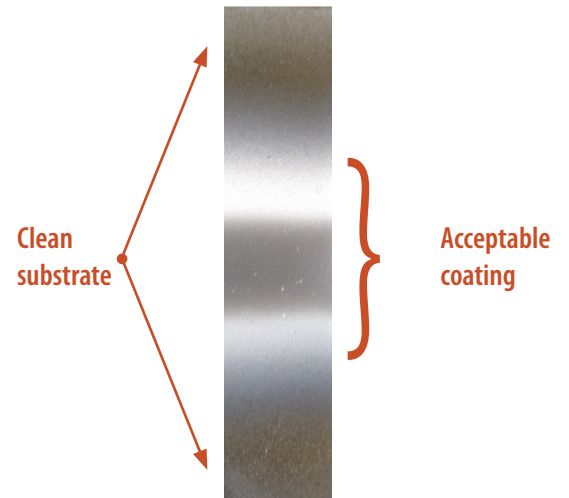
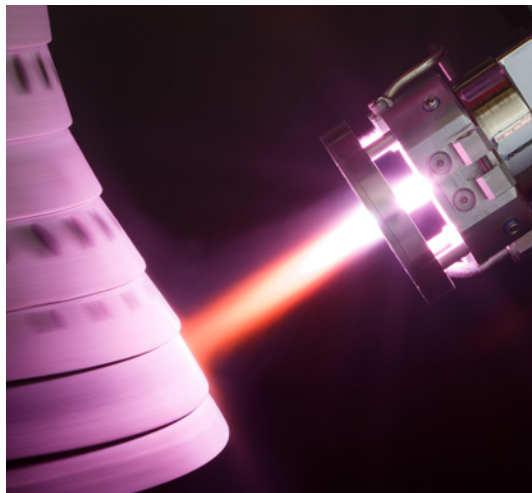
The **LiquiEdge™** is an attachment for thermal spray torches that can be used as an adjustable aperture to reduce the plume diameter. The powder particles within the plume tend to separate based upon size, so reducing the plume diameter also effectively narrows the particle size distribution (PSD) of the powder being sprayed. As a result, with the **LiquiEdge™** coatings can be produced from particles that have smaller differences in diameters, speeds, and temperatures, creating smoother, denser structures.



Wide, diverging plume with no water injection



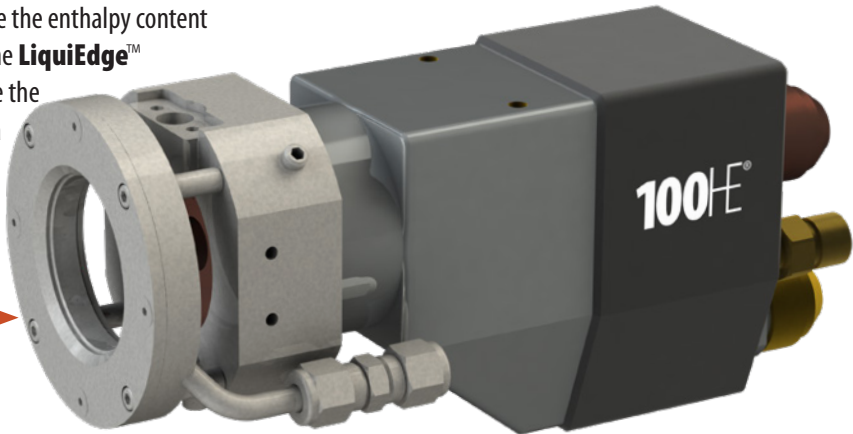
Narrow, focused plume with water injection



The 100HE® torch gets even better

Injecting water does reduce the enthalpy content of the plume. Therefore, the **LiquiEdge™** works best with a torch like the **100HE®** that can produce a high enthalpy plume.

LiquiEdge™ is added to the front of the **100HE®**

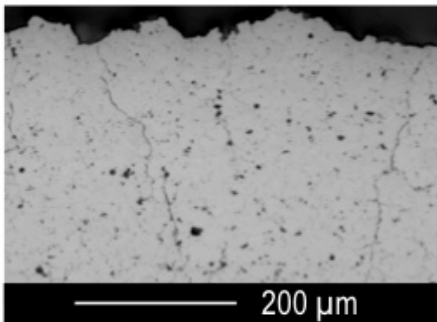


APS microstructure control

Even with water injection from the **LiquiEdge™**, the **100HE®** plume still contains enough enthalpy to deposit a dense, vertically cracked $ZrO_2 - Y_2O_3$ thermal barrier coating (TBC) by the air plasma spray (APS)

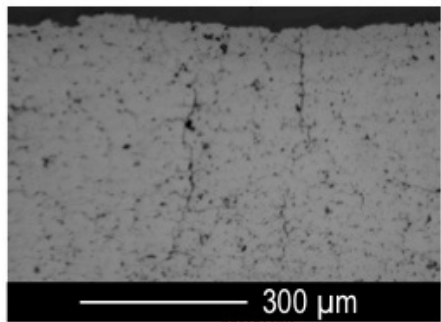
process. The narrowing of the particle size distribution provided by the **LiquiEdge™** reduced the surface roughness of the APS TBC by 55%.

Without **LiquiEdge™**

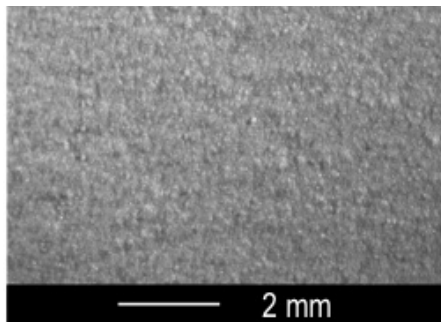
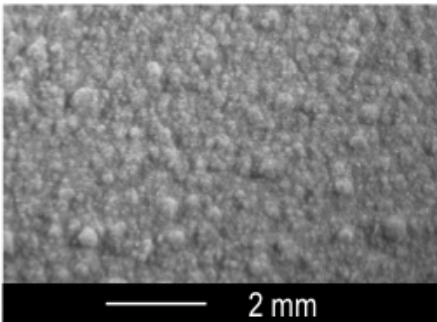


Cross section

With **LiquiEdge™**



Top surface



APS coating
 $ZrO_2 - 8 \text{ wt}\% Y_2O_3$

Surface roughness

Without **LiquiEdge™**

Ra 14.1 μm (553 μin)
Rz 101.4 μm (3987 μin)

With **LiquiEdge™**

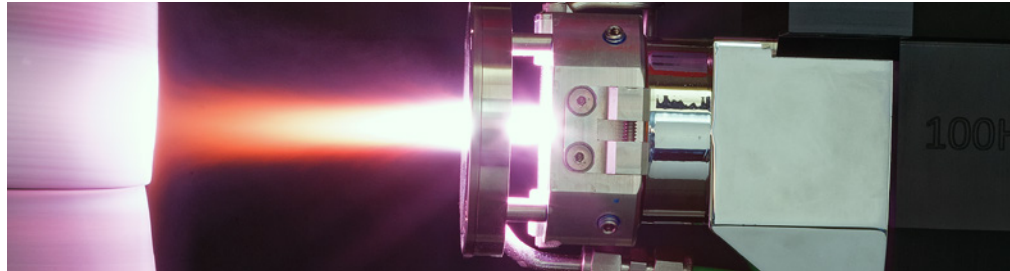
Ra 6.3 μm (246 μin)
Rz 41.6 μm (1635 μin)

SPS microstructure control

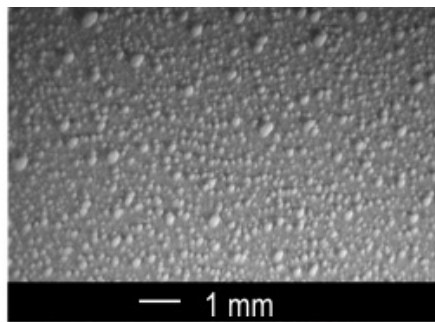
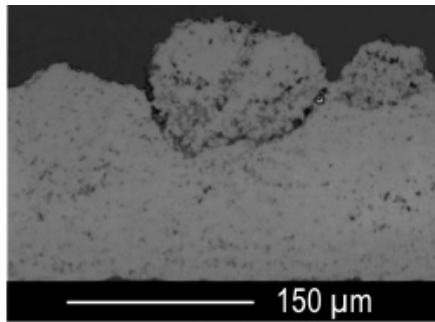
The **100HE**® with the **LiquiEdge**™ can also be used to decrease the surface roughness and porosity of coatings

made by the suspension plasma spray (SPS) process.

100HE® with the **LiquiEdge**™ spraying Y_2O_3 by SPS on a liner

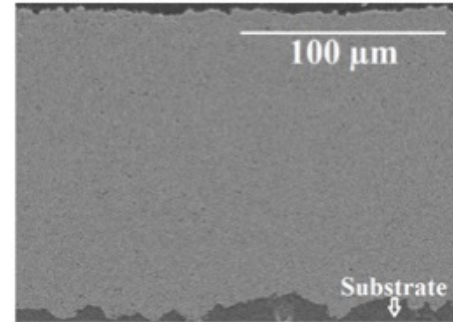


Without **LiquiEdge**™

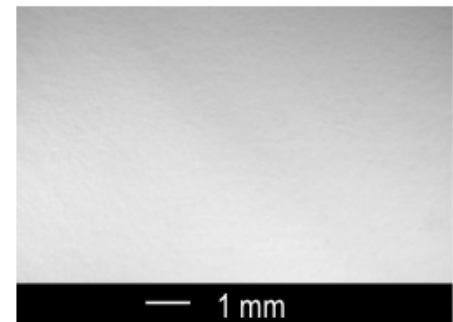


With **LiquiEdge**™

Cross section



Top surface



SPS coating
 Y_2O_3

Surface roughness

Without **LiquiEdge**™

Ra 12.3 μm (482 μin)
Rz 71.7 μm (2817 μin)

With **LiquiEdge**™

Ra 1.0 μm (40 μin)
Rz 6.5 μm (256 μin)

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