Sinter-HIP Advantages

What is Sinter-HIP?
Sinter-HIP is a method of thermal consolidation for cemented carbide wherein the simultaneous application of heat and pressure fully consolidates the carbide during the sintering process. It results in a product that contains little or no porosity, thereby producing a component that is as close to full theoretical density as possible.

Hot Isostatic Pressing (HIP) Results in Superior Reliability
Some companies sinter-HIP large parts only. At General Carbide, we sinter-HIP all parts in one of five furnaces to ensure the highest metallurgical quality. Subjecting our preforms to sinter-HIPing improves nominal transverse rupture strength, ranging from 400,000-560,000 psi. The result is parts or components that have little or no porosity and offer superior reliability in a variety of applications, including:

> Automotive
> Aerospace
> Heavy Equipment
> Industrial
> Oil & Gas

Beyond excellent transverse rupture strength, the key features of sinter-HIPed carbide preforms include outstanding:

> Compressive Strength (> 600,000 psi)
> Torsional Strength
> Improved Resistance to Deflection, Corrosion & Wear
> Higher Fracture Toughness
According to Weibull’s* Statistical Strength Theory, the strength of a brittle material is subject to the presence of a flaw of random size and random distribution located in the area of highest stress. Therefore, a stress concentration of micron size may exist in a particular area of the material and will weaken it. This phenomenon is likely to cause a scatter plot in rupture strength values and the material may fail at stress levels below specification or published strength values.

Weibull’s Theory also considers that a size effect exists, meaning the larger the part, the more likely the part will contain pits or other flaws, according to the following equation:

\[
\frac{\sigma_1}{\sigma_2} = \left[ \frac{V_2}{V_1} \right]^{\frac{1}{m}}
\]

The strength depends upon specimen volume and will decrease as the volume increases. However, the size effect decreases as the value of \(m\) (the Weibull “m” material constant) increases.

Sinter-HIPing raises the value of the material constant (“m”), thereby reducing the probability of voids, which increases the probability that the material will perform as specified.

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*Ernst Hjalmar Waloddi Weibull (1887-1979) was a French-born Swedish engineer, scientist and mathematician. In addition to publishing a paper on distribution of material flaws, Weibull published many papers on material strength fatigue and rupture in solids. He also wrote a book on fatigue analysis. The American Society of Mechanical Engineers awarded Dr. Weibull its Gold Medal in 1972. He received The Great Gold Medal from the Royal Swedish Academy of Engineering Sciences in 1978.