You'll Know When It's Time for TZM HOT RUNNER NOZZLE TIPS

As an average injection moulding operator, you would fit your hot runner systems with Copper Beryllium (CuBe) nozzle tips. And it would be a good choice. For runs with a <300˚C recommended nozzle temperature at <30,000 psi, there's nothing wrong with CuBe nozzle tips.

But moving from average to above average, and towards preferred, means you'll want the ability to work with premium materials like crystalline glass fibre polymers that require higher temperatures. And when your capabilities grow, so too will your orders; and you'll want more than 30,000 psi of pressure in your nozzle to speed up production.

But that's not when you'll know it's time to switch to something stronger.

You'll know when it becomes more cost effective to fit your machinery with higher quality rather than lower cost. You'll know when you crank up the heat and your CuBe nozzle tip, softened from the extra thermal energy, distorts in shape and ruins who-knows-how-many units before it's noticed. You'll know when your plan to apply serious pressure to make a deadline is thwarted by a melted, cracked or deformed CuBe nozzle tip.

When the time comes to graduate to a stronger material for your nozzle tips — and it will if your business grows the way you probably want it to — your best bet are nozzle tips made with TZM.

WHAT IS TZM?

TZM is the acronym for Titanium-Zirconium Molybdenum. It's made up of 99.42% molybdenum and 0.58% titanium & zirconium.

Like CuBe (97.5% copper and 2.5% beryllium, cobalt, nickel & iron), TZM is a refractory metal in that it's resistant to heat and wear, making it natural fit for the intense temperatures and stresses of the hot runner process.

TZM'S ELEMENTAL DIFFERENCE

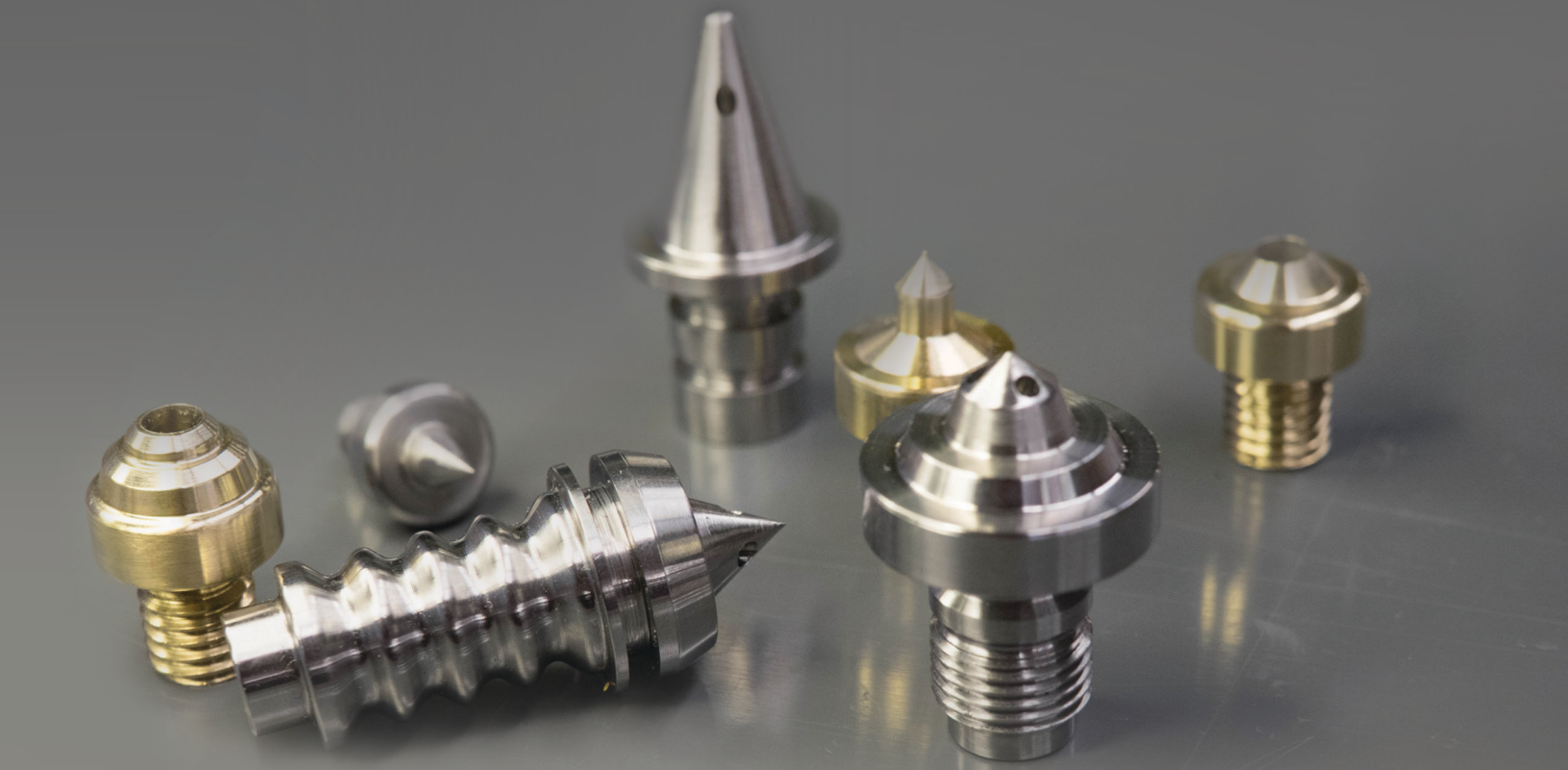
By examining the physical and thermal properties of TZM's primary material compared to CuBe's, as well as the functional benefits of the secondary materials, it's easy to see why TZM nozzle tips would work better under extreme conditions.

PRIMARY MATERIAL COMPARISON

As you can see, from the first metric[1], molybdenum has a much higher solid melting point, which means it can withstand that much more heat running through it. It can retain more of that heat because of what the second metric[2] tells us: that less of the heat being produced by the hot runner is being lost to the nozzle itself. And because of the third metric[3] (the amount of warpage you can expect due to heat), you can feel confident that the increased heat you now require is not going to damage a TZM tip like a CuBe tip would.

The bottom three metrics explain molybdenum's superior ability to withstand the force of injection moulding. It's a thicker metal than copper, as you can see by the 15% difference in density[4]. This, along with being much harder on the Brinell scale[5] (the ability to keep from being dented by fast moving particles crashing up against it as they flow through the nozzle), plays a part in the increased yield strength[6] —which means you can feel confident turning up the pressure and know your nozzle tips can handle it.

PERFORMANCE METRIC	COPPER	MOLYBDENUM
Solid Melting Point	1084.62 °C	2623 °C
Thermal Conductivity	400 W/(m K)	139 W/(m K)
Thermal Expansion	17×10^{-6} K^{-1}	4.8×10^{-6} K^{-1}
Density	8.92 g/cm^3	10.28 g/cm^3
Hardness (Brinell)	874 MPa	$1.5x10^3$ MPa
Yield Strength	60,000 lbs/in^2	75,000 lbs/in^2



SECONDARY MATERIAL COMPARISON

The beryllium in CuBe and the titanium/zirconium combination work to improve the efficacy of the primary metal even further in high pressure/high heat applications like injection moulding.

When added to copper to make CuBe, beryllium has been shown to increase the yield strength of copper to 100,000 psi. Better than copper's 60,000 psi yield strength, but not as good as TZM's 140,000 psi[7] when the titanium and zirconium are added. The former boosts the tip's strength so it bends less at high temperatures. The latter provides more corrosion resistance so the inside of the nozzle stays truer for longer.

Some manufacturers will go so far as to coat their TZM tips in CVD-deposited titanium-nitrate to maintain structure and internal hardness 36HrC for even longer under high temperature/high pressure conditions. This is particularly important when working with many of the newer, sharper polymers.

TZM'S PRACTICAL DIFFERENCE

When a CuBe nozzle tip anneals at extreme temperatures, it softens and loses its shape. The resin won't enter the mould properly and the results could be financially catastrophic. Imagine an entire product run rendered unsalvageable because of creep, poor colouring or structural inconsistence.

Of course, with CuBe tips, you can avoid this if you employ someone to monitor the operation like a hawk and check the nozzles & products regularly. But think about the extra downtime and increased costs and lost revenue you'd be forced to endure.

Alternatively, you can decide that it's time to invest in your system, put your factory in the position to work with any polymer at any temperature or pressure, and go from being an average injection mould operator to something more. To learn more about the benefits of TZM please feel free to contact us at 1-844-688-0090 or visit www.acroturn.com

1 http://periodictable.com/Elements/029/data.html, http://periodictable.com/Elements/042/data.html 2 http://periodictable.com/Elements/029/data.html, http://periodictable.com/Elements/042/data.html
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