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Zapp was founded in 1701 in Ründeroth, Germany by Hermann Zapp. Over the past 300+ years, Zapp has evolved into a global leader in premium, technologically advanced specialty materials. Today, the Zapp Group is a worldwide supplier with production facilities and service centers on three continents. Our core competencies lie in the manufacture and distribution of ready-to-use high performance materials for demanding applications. The Zapp Group’s global operations consist of three divisions: Precision Strip, Precision Wire, and Materials Engineering for tooling alloys and specialty materials. Our objective is to offer technologically advanced solutions for the most demanding applications through close cooperation with our customers.
EXCLUSIVE PRACTICAL EXPERIENCE WITH CONVENTIONAL AND POWDER METALLURGICAL STEELS

Tool makers have many options today in regard to material selection. The most demanding applications often require something better than the standard commodity tooling grades. This is where the PM alloys have much to offer.

A BACKGROUND OF 30 YEARS
Zapp Tooling Alloys is the world’s leading independent distributor of high performance PM tooling grades. Our extensive experience with this group of materials has provided a comprehensive understanding of how they can be utilized to maximum effectiveness in various market segments. This includes practical application knowledge as well as the technical wherewithal to properly guide critical heat treatment and processing steps. Our approach is to sell solutions to tooling problems that can increase productivity and reduce bottom line cost.

POWDER METALLURGICAL MATERIALS – THE OPTIMUM IN STEEL TECHNOLOGY
PM processing represents a well-established premium method used to manufacture tooling materials which eliminates many of the issues inherent with highly alloyed grades. Although higher cost, the PM process offers the ability to produce high wear resistance alloys that also maintain excellent toughness and tool fabricating characteristics. This enables PM grades to satisfy the most demanding requirements including long run tooling as well as applications that involve difficult work materials or generally require a high level of consistency and reliable performance.

PRACTICE MAKES PERFECT PRODUCTS
Our practical experience and market involvement is not only a help to customers. It also serves as a driving force for quality improvement and product innovation realized by maintaining close technical relationships with producing mills. Our position as an independent distributor also allows us to take advantage of the strengths of each of the producing mills thereby guaranteeing a stable supply chain.

TECHNOLOGICAL INNOVATION THAT COUNTS
Needless to say change is constant and new challenges are being encountered daily in many industries including automotive, plastics, food processing, general metalworking and others. In many ways, tooling must adapt to meet new requirements and selection of the appropriate tool material and treatment has become an even more critical aspect relative to achieving overall success. It is within this context that Zapp Tooling Alloys strives to become a valued resource by providing a materials engineering oriented approach that complements our value-added, service-oriented distribution capabilities.
Z-SERIES PM STEEL

THE PM PROCESS
The PM (Particle Metallurgy) process for the production of high speed and tool steels was developed nearly 50 years ago as a mechanism to produce highly alloyed steel grades that are free from the detrimental effects of alloy segregation. As more highly alloyed tool steels were produced through conventional ingot casting, the resulting microstructures exhibited large carbides that, while improving the wear and heat resistance of tool steels, caused a precipitous drop in the overall toughness of the material. With the PM process, alloy segregation is eliminated which enhances material toughness while higher carbide volume further improves resistance to heat and wear.

1. Atomization
2. Powder
3. Screening
4. Filling
5. Capsulation
6. Hot isostatic pressing
7. Hot forging
8. Hot rolling

GENERIC PM PROCESS
**ANALYSES AND PROPERTIES**

**Z-SERIES PM**

<table>
<thead>
<tr>
<th>Steel grade</th>
<th>C</th>
<th>Cr</th>
<th>Mo</th>
<th>W</th>
<th>V</th>
<th>Co</th>
</tr>
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<tbody>
<tr>
<td>Z-Wear PM®</td>
<td>1.15</td>
<td>7.50</td>
<td>1.60</td>
<td>1.0</td>
<td>2.40</td>
<td>-</td>
</tr>
<tr>
<td>Z-M4 PM®</td>
<td>1.42</td>
<td>4.00</td>
<td>5.25</td>
<td>5.50</td>
<td>4.00</td>
<td>-</td>
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<tr>
<td>Z-A11 LV PM®</td>
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<td>5.25</td>
<td>1.30</td>
<td>-</td>
<td>9.00</td>
<td>-</td>
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<tr>
<td>Z-A11 PM®</td>
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<td>5.25</td>
<td>1.30</td>
<td>-</td>
<td>9.75</td>
<td>-</td>
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<tr>
<td>Z-T15 PM®</td>
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<td>12.00</td>
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<td>5.00</td>
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<td>Z-M48 PM</td>
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<td>4.00</td>
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<td>9.75</td>
<td>3.10</td>
<td>9.00</td>
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<tr>
<td>Z-MAX PM</td>
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<td>4.00</td>
<td>5.00</td>
<td>10.00</td>
<td>5.00</td>
<td>9.00</td>
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**CHEMICAL COMPOSITION (STANDARD VALUES IN %)**

**MECHANICAL PROPERTIES OF Z-SERIES PM MATERIALS**

- Wear resistance
- Impact toughness
CRUCIBLE PARTICLE METALLURGY/CPM® SHEET

Zapp Tooling Alloys, Inc. stocks a large selection of Crucible Particle Metallurgy/CPM® sheet for your flat requirements under .500” thick. All material melted at Crucible Industries is supplied in the Hot Rolled Annealed condition. Save time and money at Zapp by using material as close to your finished part dimensions as possible.

Zapp offers many value added services for our CPM® sheet product line including cold sawing, shearing, laser and water jet cutting and grinding to your exact dimensions. Send us your drawing and we can supply a semi-finished blank for your convenience.

Our stocking program includes CPM® REX® M4, CPM® 10V®, and CPM® REX® T15, however, we accept inquiries for all CPM® grades and thicknesses including CPM® 1V®, CPM® 3V®, CPM® 9V®, CPM® 15V®, CPM® REX® 76, CPM® REX® 86, and CPM® S90V®. Ask your local Zapp Account Manager about our CPM® sheet custom stocking programs for JIT delivery of your specific sheet, strip or blank requirement.

<table>
<thead>
<tr>
<th>Hot Rolled Thickness</th>
<th>CPM® REX® M4</th>
<th>CPM® 10V®</th>
<th>CPM® REX® T15</th>
</tr>
</thead>
<tbody>
<tr>
<td>.056”/.062”</td>
<td></td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>.070”/.078”</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>.074”/.082”</td>
<td>-</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>.085”/.095”</td>
<td>-</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>.110”/.120”</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>.139”/.156”</td>
<td>-</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>.150”/.166”</td>
<td>-</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>.156”/.172”</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>.172”/.193”</td>
<td>-</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>.228”/.253”</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>.290”/.315”</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>.358”/.388”</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>.420”/.450”</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</tbody>
</table>

CPM, REX, 1V, 3V, 9V, 10V, 15V, and S90V are registered trademarks of Crucible Industries, LLC.
Zapp’s ZDM Blanks offer the convenience of a precision ground, pre-hardened PM block ready for the EDM process.

Eliminate the wait for costly grinding and heat treating. Zapp has high performance Z-Series PM Blanks ready to EDM.

Quality PM Steels and Quality Heat Treatment.

Non-Standard grades, thicknesses, widths and lengths are available upon request.
MAIN ADVANTAGES OF THE POWDER METALLURGICAL HIGH PERFORMANCE STEELS

POWDER METALLURGICAL MICROSTRUCTURE

PM HIGH PERFORMANCE STEEL
Positive effects of the uniform microstructure for best cutting edge stability.

ADVANTAGES

1. ALLOYS
Higher alloy levels can be manufactured while maintaining good mechanical characteristics.

2. TOUGHNESS
The uniform distribution of carbides and absence of metallurgical defects improve fracture and fatigue strength.

3. WEAR RESISTANCE
Higher carbide volume increases resistance to both abrasive and adhesive wear.

4. GRINDABILITY
Machining ability is improved as a result of the small globular carbides.

5. DIMENSIONAL STABILITY
PM steels are free from segregation leading to substantially improved dimensional stability.

CONVENTIONAL MICROSTRUCTURE

CONVENTIONAL HIGH SPEED STEEL
Carbide clusters near the cutting edge produce micro- and macro-chipping.
Zapp Tooling Alloys, Inc. offers numerous value-added services to help you shorten lead times, solve customer problems and save money on the bottom line.

**CUTTING**

**COLD SAW**
Custom cutting of our round and flat products to your required dimensions on our Kasto Plate saws or Behringer cut off saws

**WATER JET**
Custom processing of semi-finished blanks per customer drawing

**LASER**
Custom processing of semi-finished blanks per customer drawing

**SHEARING**
Strip production on sheet product

**MILLING/GRINDING**

**FLATS**
Two, four or six side milling or precision Mattison (+/- .002") or Blanchard (+/- .005") grinding

**ROUNDS**
Centerless grinding to +/- .0001"

**BORING**
Gundrilling, boring or trepanning of all in stock diameters

**FORGING**
Local forging of discs and rolled rings up to 72" in diameter as well as full machining services

**METALLURGICAL SERVICES**
Technical consultation is always available relative to application questions, treatment options and general problem solving. This service is backed by metallurgical lab capability that can be utilized for microstructural analysis, product verification, and tooling failure analysis. Our experienced sales staff and Technical Director are available to assist our customers throughout the manufacturing process and up to and including end user performance upon request.

**PACKAGING**
Our use of custom packaging materials and equipment ensure that your order can be received safely and efficiently upon arrival at your facility. Zapp warehouse personnel take great pride in their work and want it to show in every detail.

**LOGISTICS**
Zapp Tooling Alloys, Inc. has partnered with the most reputable freight carriers in the industry to ensure the shortest possible transit times to our customers. These partners are truly an extension of our company and can be counted on to get our product to your dock exactly as it left our service center.
ZAPP MATERIALS ENGINEERING

TOOLING ALLOYS

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