Wear parts for the automotive industry
CERATIZIT – secrets of success

Secrets of success

• CERATIZIT is your partner for exceptional hard material solutions. Hard materials and tools from CERATIZIT – our solutions to complex problems are an integral part of our customers’ success. Our products guarantee: economy – long life – speed! And it is precisely this combination which gives our business partners a direct competitive advantage.

• Premier performance is only possible through a total appreciation of the requirements of our business partners. A performance achieved through flexible thinking and continuous dialogue with our customers. A pioneering spirit and a deep understanding of powder metallurgy characterize the history of CERATIZIT. One of the attributes of our company philosophy is the search for perfection: target oriented – sustainably – passionately!

• Intensive research and development activities, taking into account the precise requirements and working processes of the customer, are today’s investment for the solutions of tomorrow – and beyond.

Corporate values

1. The views and focus of our business partners matter
2. Innovative and flexible thinking matters
3. Communication matters
4. Employee development matters
5. Professionalism matters
6. Our environment matters

Tailored solutions for wear parts

• Hard materials in general and hard metals in particular are characterised by a range of interesting properties for all applications where maximum wear resistance is required.

• The stress exerted on wear parts during application is above all defined by various interacting factors. High pressure, high temperature, the application of abrasive or aggressive media, and the machining of hard materials are only some examples of factors that cause wear and to which hard materials and hard metals must be resistant. The powder metallurgical production of CERATIZIT wear parts enables tailored adaptation of the tool properties to the wear criteria.
Cemented carbide is a hard material with mechanical properties that can be adjusted within a very wide range, given its composition and microstructure. The hardness and toughness range of the CERATIZIT grades includes everything from wear resistant tool steel to super-hard ceramic materials.

The classification of the carbides with regard to grain size corresponds to the recommendations of the Powder Metallurgy Association.

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The hard material provides:
- Hardness
- Wear resistance

The metallic binder provides:
- Toughness
- Wear resistance, hardness
- Compressive strength
- Impact strength
- Transverse rupture strength
- Tribological properties
- Specific weight
- Magnetic properties
- Modulus of elasticity, rigidity
- Thermal properties
- Corrosion resistance, resistance to oxidation
Tailor-made hard materials for wear part applications

Combination of properties: hardness (= resistance to wear), transverse rupture strength and toughness.

CEMENTED CARBIDE

WC-Co  WC-(Ni, Co)  WC-(Fe, Ni, Co)

➢ High density (> steel)
➢ Electrical conductivity
➢ High transverse rupture strength
➢ High compressive strength

Application range:
for example, processing technology
metal forming
tool construction
automotive industry
chemical industry

CERMETS

Ti(C, N) – Mo₂C – WC – Co/Ni, TiC – Mo₂C – Ni

➢ Medium density (~ steel)
➢ Reduced tendency to diffusion
➢ High heat resistance
➢ High oxidation resistance
➢ Reduced tendency to adhesion
➢ High edge strength
➢ Good chemical resistance

Application range:
for example,
watches and jewellery
metal forming

SILICON NITRIDE

Si₃N₄

➢ Low density (<< steel)
➢ Good friction properties
➢ High resistance to thermal shock
➢ Very good chemical resistance
➢ No electrical conductivity
➢ Good mechanical properties up to 1200 °C

Application range:
for example,
roll body
metal forming
automotive industry
Tailor-made hard materials for wear part applications

Properties of cemented carbide in dependance of Co content and WC grain size

**HARDNESS (=WEAR RESISTANCE)**

**Water-jet cutting**
- **Type of stress**
  - Wear
  - Corrosion

**Carbide grade**
- Very high hardness: 2650 HV30
- Small grain size: <0.5 μm
- Low Co content: 0.4%
- Corrosion resistance when
  - adding Cr3C2

**Cobalt content ↓↓**
**Grain size ↓↓**

**TOUGHNESS**

**Hot rolling**
- **Type of stress**
  - Wear due to abrasion
  - Built-up edge

**Carbide grade**
- Sufficient fracture toughness: Co content 20%
- Good wear resistance: 1030 HV30
- Binder metal layer as thin as possible
  - low tendency to adhesion
- Medium grain size 1.5 μm

**Micro-drilling**
- **Type of stress**
  - Wear
  - Deflection (breakage)

**Carbide grade**
- High bending strength: >4000 MPa
- Small grain size: <0.5 μm + VC
- Co content: ~ 8.5%
- High wear resistance: 1930 HV30

**Cobalt content ↑↑**
**Grain size ↓↓**

**TRANSVERSE RUPTURE STRENGTH**

**Hot rolling**
- **Type of stress**
  - Wear due to abrasion
  - Built-up edge

**Carbide grade**
- Sufficient fracture toughness: Co content 20%
- Good wear resistance: 1030 HV30
- Binder metal layer as thin as possible
  - low tendency to adhesion
- Medium grain size 1.5 μm

**Cobalt content ↑↑**
**Grain size ↑↑**
CERATIZIT hard materials for better performance

➢ Valve Seats
➢ Fuel Pump Rollers
➢ Cam Rollers
➢ Roller Bearings
➢ Engine Valves
➢ Solenoid Valve
➢ Seats Inserts
➢ Injector Levers
➢ Axes
➢ Valve Pistons
➢ Polygon
Tailor-made materials for the automotive industry

Ever increasing stress on motors and similar systems requires properties which cannot be fully satisfied by conventional materials. The CERATIZIT hard materials which are produced applying powder metallurgy are characterized by corrosion resistance and resistance to oxidation, the capability to bear high mechanical stress, long tool life without damaging the surface and the possibility of inexpensive high volume production.

The long-standing experience in the production of hard materials and the implementation of development projects together with our customers guarantee high competence with regard to sophisticated wear part solutions in the automotive industry. Our QA management systems correspond to ISO 9001.
Material properties

Physical properties

Vickers hardness at room temperature

Density at room temperature

Mechanical properties

Transverse rupture strength at room temperature

Specific rigidity at room temperature

(= modulus of elasticity / density)

Thermal properties

Thermal conductivity at room temperature

Thermal expansion coefficient at 20 – 400°C
Grade characteristics

Modulus of elasticity, Poisson’s ratio, density and thermal expansion coefficient

WC-Co carbide

<table>
<thead>
<tr>
<th>GRAIN SIZE SUBMICRON</th>
<th>GRAIN SIZE ULTRAFINE</th>
<th>CORROSION RESISTANT GRADES</th>
<th>CERMETS (TiC-BASIS CARBIDES)</th>
<th>SILICON NITRIDE (Si₃N₄)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERATIZIT grade</td>
<td>Grades</td>
<td>Density</td>
<td>Binder [wt. %]</td>
<td>Hardness [MPa]</td>
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CERATIZIT – worldwide

• Production sites in the three big economic areas with a worldwide network of CERATIZIT sales and support engineers plus many CERATIZIT distribution partners guarantee customer vicinity.

• We maintain the dialogue with our customers and strive for long-term partnerships.

Find your personal distribution partner at:

www.ceratizit.com

CERATIZIT worldwide production sites and support centres
CERATIZIT worldwide sales centres
CERATIZIT worldwide distribution partner network

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