PREMIUM ALUMINA
FOR POLISHING APPLICATIONS
Almatis – The Premium Alumina Company

With more than 100 years of alumina expertise, Almatis is the world’s leader in the development, manufacture and supply of premium alumina and alumina-based products.

Almatis is both a global and fully integrated producer, serving our customers from sixteen strategically located sales, research and manufacturing sites. Our employees strive to exceed customers’ expectations through industry-leading customer service, technical support and manufacturing excellence. We implement leading technologies and continuous improvement programs, which have established Almatis products as the benchmark for quality and consistency. Our commitment to strong partnerships with our customers creates innovative solutions that support and enhance their growth in all regions of the world.

Almatis offers the most comprehensive alumina product portfolio in the industry. Our broad product line includes:

- Tabular aluminas
- Calcined and reactive aluminas
- Polishing aluminas
- Calcium aluminate cements
- Alphabond 300
- Dispersing aluminas
- Brown sintered alumina, BSA 96
- Alumina and magnesia-rich spinels
- Calcium hexa-aluminates, Bonite and SLA-92

Across our core markets—refractories, ceramics and polishing—we deliver one-stop shopping, always expanding our portfolio to meet customer and market requirements.

QUICK FACTS:
- Global specialty alumina producer with over 100 years of expertise
- Most comprehensive alumina portfolio
- Closer to our customers with highest quality products
- Reliable and secure supply from our refinery and 9 world-class production facilities
- Excellent global and local service with leading-edge technical support
- Continuous development of innovative solutions and applications know-how
Alumina is one of the most important abrasive materials for polishing a wide range of surfaces. Almatis polishing aluminas enable the user to effectively achieve high cut and high shine.

Almatis offers the broadest polishing portfolio in the industry and with this wide selection we offer the most efficient solution for each customer’s specific need.

Tight specifications for surface area, as well as very narrow particle size distributions and well defined top cuts, ensure the consistency of Almatis polishing aluminas.

The degree of calcination, the size of both the agglomerates and the primary crystals, and the particle shape of the alumina directly influence the quality of the finished surface.

With large primary crystals and agglomerates, the cutting effect is greater. Conversely, with smaller primary crystals and agglomerates, the shine of the surface is higher.

At the beginning of the polishing process, the alumina agglomerates break down, giving defined surface abrasion rate. As the primary crystals are released, a polishing action begins, defining the final surface quality.

Polishing Material Matrix

<table>
<thead>
<tr>
<th>Cut</th>
<th>Shine</th>
<th>Surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>LOW</td>
<td>BET &lt; 0.4 m²/g</td>
</tr>
<tr>
<td>HIGH</td>
<td>HIGH</td>
<td>BET 0.4-0.6 m²/g</td>
</tr>
<tr>
<td>medium</td>
<td>medium</td>
<td>BET 0.6-3 m²/g</td>
</tr>
<tr>
<td>soft</td>
<td>soft</td>
<td>BET &gt;3-17 m²/g</td>
</tr>
<tr>
<td>very soft</td>
<td>very soft</td>
<td>BET &gt;17 m²/g</td>
</tr>
</tbody>
</table>

APPLICATIONS FOR THE DIFFERENT GRADES:

- **PLATY**: mainly for lapping of silicon wafers
- **HARD**: pre-polishing of metals and ceramic media for vibratory finishing
- **MEDIUM**: brake pads and pre-polishing of metals
- **SOFT**: finishing of all types of materials, brake pads, automobile polishing
- **VERY SOFT**: polishing of silver, cleaning of stones
Platy alumina
Almatis has the special capability to produce alumina crystals with a very unique particle size and shape. Products P20 and P25 have an average particle size of 20 and 25 micron, respectively, and a plate-like structure which remains stable during milling. Even the ground version, Gilox 63, still has a large primary crystal size. Of additional value, this family of platy, specialty aluminas are transparent. They are used for several diverse applications such as lapping of silicon wafers and wear resistant coatings.

### Product Comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>P20</th>
<th>P25</th>
<th>Gilox 63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Crystal Size [µm]</td>
<td>16</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>Oil Absorption [%]</td>
<td>20-60</td>
<td>25-65</td>
<td>10-25</td>
</tr>
</tbody>
</table>

**APPLICATION:** Quartz crystal lapping

**Transparency of P25 crystals**

**Platy structure of P25**
### Metal Polishing

#### Metal polishing – Pre-polishing

Metal polishing is the largest polishing application for Almatis premium aluminas. To achieve a high surface quality, a two-step approach is suggested. For the pre-polishing step, Almatis offers the hard calcined PSG series with surface areas of 0.4-0.6 m²/g.

Product A2 A2-325 CR PSG100 PSG1125 PSG140 PSG140I PSG300

<table>
<thead>
<tr>
<th>Top Cut</th>
<th>&gt;150µm &gt;3%</th>
<th>&gt;85µm &lt;1%</th>
<th>&gt;205µm &gt;1%</th>
<th>&gt;125µm &gt;4%</th>
<th>&gt;125µm &gt;0.5%</th>
<th>&gt;40µm &lt;3%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Absorption [%]</td>
<td>50</td>
<td>15</td>
<td>41-54</td>
<td>35-50</td>
<td>35-50</td>
<td>12-22</td>
</tr>
</tbody>
</table>

The newly developed PSG140 is especially effective on aluminum surfaces, but it can also be used on other metals where high cutting performance is needed. The higher quality surface resulting from the use of PSG140 will lead to time and material savings in the final polishing step.

#### Metal polishing – Finishing/Brightening

For the finishing of metal products, Almatis supplies a broad portfolio with unique performance in the 3-17 m²/g surface area range. Almatis will customize optimum individual solutions for cutting, as well as for polishing and brightening.

Product P2 P30 A13-325 P730 P10 feinst

<table>
<thead>
<tr>
<th>Top Cut</th>
<th>&gt;90µm &lt;0.5%</th>
<th>&gt;85µm &lt;0.1-3%</th>
<th>&gt;65µm &lt;6%</th>
<th>&gt;40µm &lt;3%</th>
<th>&gt;25µm &lt;3%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Absorption [%]</td>
<td>35-45</td>
<td>30-40</td>
<td>30</td>
<td>30-40</td>
<td>30-40</td>
</tr>
</tbody>
</table>

With a range of production techniques, Almatis can tailor the particle size distribution to each customer’s requirements.
For paint polishing, such as automobile finishes, Almatis products achieve in parallel both high cutting and good polishing performance. This outstanding performance results from our capability to manipulate particle size distributions to achieve fully ground, fine ground or coarser agglomerated distributions with the same primary crystal size. Two prime examples are P10 feinst and P815/P816, which are often used in higher performance finishes and can provide both high cut and a good polishing effect without microcracks. For less sensitive applications, P2 and P2 FR are recommended.

**Paint Polishing**

<table>
<thead>
<tr>
<th>Product</th>
<th>P2 FR</th>
<th>P2</th>
<th>P10 feinst</th>
<th>P815/P816</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Cut</td>
<td>&gt;90µm &lt;0.5%</td>
<td>&gt;90µm &lt;0.5%</td>
<td>&gt;20µm &lt;3%</td>
<td>&gt;45µm &lt;0.8%</td>
</tr>
<tr>
<td>Oil Absorption [%]</td>
<td>40-50</td>
<td>35-40</td>
<td>35-40</td>
<td>43</td>
</tr>
</tbody>
</table>

- **P2 FR**: Ground distribution of fine crystals
- **P2**
- **P10 feinst**: Ground distribution of fine crystals
- **P815/P816**: Agglomerated distribution of fine crystals
Alumina is used in brake pads to clean contamination from the disc or drum coming from wear of other brake pad ingredients, especially carbon-based raw materials. Almatis premium aluminas are typically used as 2-10% of the pad formulation, depending upon whether it is a drum or a disc brake system.

The main function of the brake is converting kinetic energy into heat by friction. Disc brakes are generally considered superior to drum brakes, as they dissipate the heat more effectively and therefore perform better. With disc brakes greater braking forces can be achieved, but this results in higher temperatures being generated on the brake pads. Alumina has high heat resistance and its stability at high temperatures makes it an ideal brake pad component. Almatis' hard and medium crystalline grades are preferred for these systems.

Drum brake
Soft burned grades such as P02, P6 and A13 -325 are preferred.

Disc brake
Hard or medium crystalline grades such as P66 M, PSG300, A267 or A2 -325 CR are recommended.

<table>
<thead>
<tr>
<th>Product</th>
<th>P66 M</th>
<th>A267</th>
<th>PSG300</th>
<th>P6</th>
<th>A13 -325</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Cut</td>
<td>&gt;125µm</td>
<td>&gt;125µm</td>
<td>&gt;125µm</td>
<td>&gt;105µm</td>
<td>&gt;125µm</td>
</tr>
<tr>
<td>Oil Absorption [%]</td>
<td>14-25</td>
<td>47-50</td>
<td>12-22</td>
<td>37-47</td>
<td>30</td>
</tr>
<tr>
<td>D50 [µm]</td>
<td>5</td>
<td>20</td>
<td>4.9</td>
<td>33</td>
<td>4.5</td>
</tr>
</tbody>
</table>

APPLICATION: Brake pads
Brake Pads

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Disc brake
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<tr>
<th>Product</th>
<th>P66 M</th>
<th>A267</th>
<th>PSG300</th>
<th>P6</th>
<th>A13 -325</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Cut</td>
<td>&gt;125µm</td>
<td>&gt;125µm</td>
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<td>33</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Stone polishing
After stone grinding, which is normally done with SiC or white fused alumina, the stone surface is pre-polished with a coarse, soft-burned alumina like A13, P6 or P2. For the finishing step, fine ground, soft-burned aluminas like P30, P730 or A13-325 are best.

Household cleaners
Many household cleaning products contain alumina for the removal of dirt, oxidation or other substances. Alumina offers high rates of material removal and remains inert over a wide pH range. Depending on the application, soft polishing materials like P2, P30, P730 or P10 fine are ideal.

Cosmetics
Almatis premium alumina is used in cosmetic applications like toothpaste and facial cleansers. For these applications, soft and very fine materials are required to remove discoloration on teeth or act as an exfoliant for the skin.
Alumina Expertise Starts in our Research Labs

With experience accumulated over more than 100 years, Almatis has acquired in-depth knowledge about the relationship between crystal morphology, primary crystal size and shape, and the resulting polishing performance of the alumina. Our application engineers are able to create unique polishing products perfectly matching the needs of our customers. Almatis has multiple laboratories worldwide dedicated to product development. Technology advancements in cutting performance and the brightening effect of different polishing grades are continuously made.

Cutting effect
Almatis researchers have developed a unique test method that can quantify alumina abrasive-ness on any material.

Polishing effect
Almatis evaluates polished surfaces with advanced techniques to determine critical parameters such as roughness indicators and reflected light as a function of the wavelength.

In cooperation with our customers, we engineer ever more precise test methods, enabling us to better understand the needs of our customers and to develop superior polishing grade aluminas to meet those needs. Almatis is committed to continually expanding our alumina expertise to meet our customers’ challenges.
### Selection of Polishing Aluminas for Your Application:

<table>
<thead>
<tr>
<th>Application</th>
<th>Very Soft (Microcrystalline)</th>
<th>Soft (Medium Crystalline)</th>
<th>Medium to High (Medium Crystalline)</th>
<th>Very High (Coarse and Platy Crystals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal pre-polish</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Metal polish</td>
<td>P2</td>
<td>A13-325</td>
<td>P730</td>
<td>P10</td>
</tr>
<tr>
<td>Aluminium</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Wood</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Glass</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Electronics</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Brake pads</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Stones</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Jewelry</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Paint</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
<tr>
<td>Cleaners</td>
<td>P15/PR16</td>
<td>A13UG</td>
<td>P8</td>
<td>A2</td>
</tr>
</tbody>
</table>

Almatis is committed to the global and secure supply of premium alumina products. Our focus on quality enables us to offer high-performance products with a long service life. Our premium alumina products are made to global standardized specifications to facilitate supply from any plant to any region. Additionally, we offer tailor-made product solutions to specific market and customer needs. Global quality and health and safety standards are rigorously applied in all our locations around the world. Almatis manufacturing facilities comply with EHS standards and ISO 9001, ISO 14001, and OHSAS 18001 to ensure high and consistent quality, while protecting the environment as well as our employees and contractors.

Almatis has a worldwide network of technical and sales specialists that understand application requirements and the latest market trends. Their in-depth knowledge allows the development of innovative new product solutions to enhance our customers’ business. Six regional research and application laboratories work in close cooperation with our customers to optimize formulations and solve all application challenges.

For you, our customer, Almatis specialists are here to help.

For solutions to your alumina needs, contact us at polishing@almatis.com

*All data contained in this brochure represent typical properties obtained by Almatis test methods and are not intended to be taken as guaranteed values or specifications.*
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Think alumina, think Almatis.