

*TECAPOWDER PI as a Binding Resin for
Diamond and CBN Grinding Wheels*

TECAPOWDER PI polyimide is a non-meltable polymer that improves the performance of grinding wheels in demanding applications. It is based on P84® by Evonik. The binding materials require high strength at elevated temperatures. These requirements are met by polyimides due to their chemical structure.

Polyimide bindings offer best thermal stability combined with extremely high strength

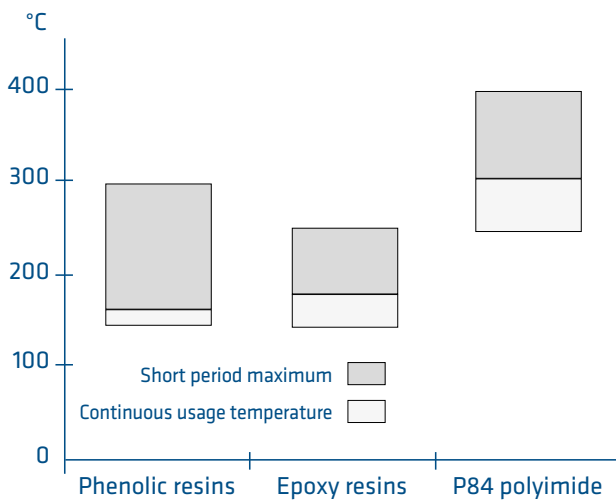
Polyimide bindings, in general, offer highest thermal stability in comparison with other polymers such as polyamides, epoxies and polyetherketones. This together with its extremely high strength make TECAPOWDER PI polyimide a natural choice for the binding resin in high quality diamond grinding wheels and which eliminate practically all other potential polymers except polyimides.

TECAPOWDER PI resin bonded wheels are capable of very high grinding speeds and, in many cases, outlast standard epoxy or phenolic wheels by a factor of 2.

Influencing the properties by changes of the processing

The hardness, brittleness and abrasion capacity of TECAPOWDER PI wheels can be influenced by processing. Varying the sintering temperature and dwell time can lead to different mechanical properties of the resin. As the process temperature and dwell times rise, the grinding area becomes harder and more brittle. This temperature moulding window is between 330 and 360 °C (626 and 680 °F).

Usage temperatures of phenolic, epoxy and polyimide resins



Outstanding properties

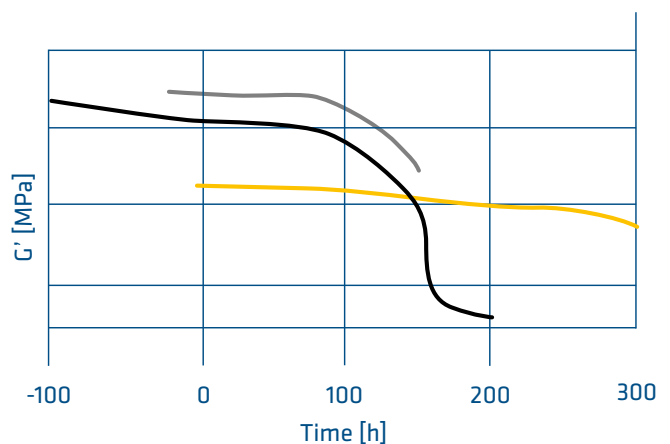
The physical properties of TECAPOWDER PI meet the requirements, which are demanded from grinding wheels. TECAPOWDER PI has a high glass transition temperature of 330 - 340 °C (626 - 644 °F) based on the moulding parameters used to sinter the resin.

High load bearing capacity

Due to its excellent thermal stability, TECAPOWDER PI bonded wheels have extremely high load-bearing capacity. They are particularly well suited for applications involving hard metal (dry) grinding and deep grinding (wet) operations.

Elastic shear modulus G' [MPa]

TECAPOWDER PI polyimide resin maintains a high level of stiffness at elevated temperatures.



Extent of delivery

TECAPOWDER PI resin is available in powder grain sizes of 200 mesh, 325 mesh, 425 mesh and 1200 mesh. Usually powder grain size of 325 mesh HCM is used. Primer solutions of 10 % Polyimid Powder in NMP (N-methyl-pyrrolidone) is also available.

Processing Guidelines

Optimise the formulation

To obtain successful grinding results, it is necessary to utilise the appropriate resin and optimise the formulation depending on the end-use. Listed here are various formulations tested in dry grinding applications. The use of Ni coated diamonds is necessary. In dry grinding applications, approximately 30 % copper powder should be added.

Preparing of the resin

As polyimide resins are hygroscopic, they have to be predried at 120 °C (250 °F) for a couple of hours before any use. It is also always important to have the exact filling proportion in case of "close mould" moulding.

Primer Coating

The primer solution should be applied thinly to the roughened bonding surface (using a brush) and dried for about 10 hours at 250 °C (480 °F).

Processing and manufacturing routines

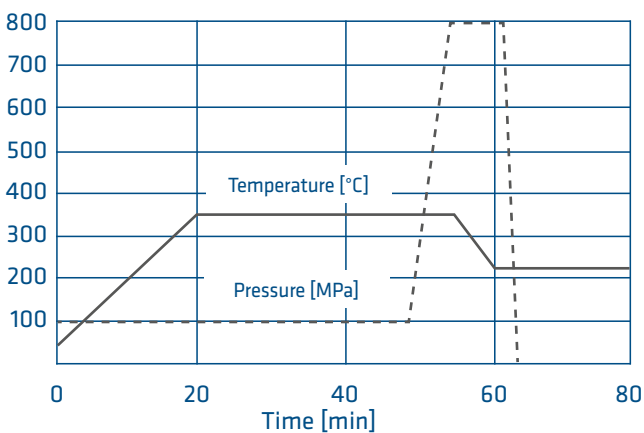
In manufacturing grinding wheels, two different methods are commonly used:

- Moulding of the grinding area and adhere this afterwards on to the hub by using epoxy adhesive. The moulding of the composition can be done in following the cycle in the graph underneath. Grindings with little volume% part of PI pressure should be raised up to 100 MPa (14,000 psi). The mounting should be done under use of an epoxy adhesive with a high amount of aluminium powder (for example 60 % Al).
- The moulding of the grinding are directly on the prepared hub (roughed and primed) can be done in the same way. In both cases the sintered wheel can be released at 230 °C (446 °F). Post curing is not necessary! Especially in the production of 1A1 wheels, a resin bounded hub is often used. We split it up into:
 - Phenolic-prepreg hubs
 - PI/metal blended types

In case of phenolic prepreg hubs the grinding area is moulded first. The prepregs are added afterwards into the outside ring and moulded as recommended for this resin. Due to the high thermal stability of Polyimid Powder no damage of the grinding area will be obtained.

Under the use of metal/resin blends we recommend the use of a 70 % metal and 30 % resin composition. The metal component can be a blend of bronze and aluminum. This hub has to be sintered as an independent part of the wheel, afterwards the grinding area is added by sintering it on to the disc.

General temperature/compression cycle on moulding of polyimides



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The Ensinger Group is engaged in the development, manufacture and sale of compounds, semi-finished materials, composites, technical parts and profiles made of engineering and high-performance plastics. To process the thermoplastic polymers, Ensinger uses a wide range of production techniques, such as extrusion, machining, injection moulding, casting, sintering and pressing. With a total of almost 3,000 employees at over 30 locations, the family-owned enterprise is represented worldwide in all major industrial regions with manufacturing facilities or sales offices.

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