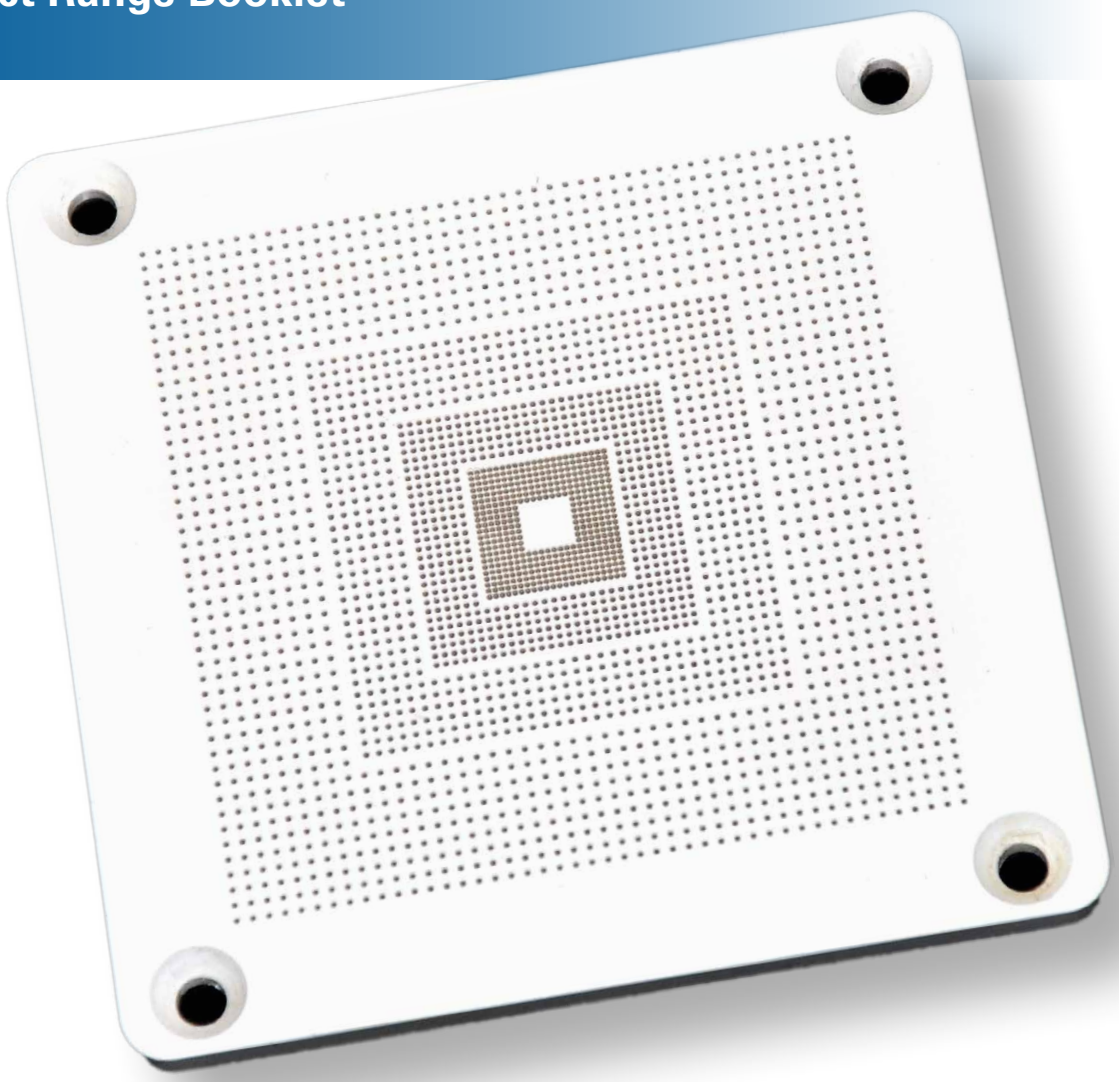
# IC Test Sockets, Nests & Handlers

## Product Range Booklet



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# The Best Materials for Burn-in Test Sockets Nests & Handlers

Next-generation chips have an ever-shrinking footprint in which to synchronize memory, logic, and digital signal processing. Fine-pitch semiconductor devices are the engines for giving cell phones and personal digital assistants more bells and whistles. **As the market gravitates toward denser arrays and smaller IC packaging, designers of burn-in and test sockets (BiTS) must incorporate new materials to support pitch requirements of 0.5 mm and finer**.

Sockets are critical to the back-end testing of finished and semifinished chips under a variety of highly stressed burn-in conditions. For example, failure testing can be accelerated by continually baking the devices in a 150°C (302°F) oven, then exhaustively testing them under these adverse conditions. (Newer protocols involve simultaneous baking and functional testing to save time and reduce costs.)

In other inspection testing, wafers and devices cycle through test fixtures where their circuits are probed and verified. Here environmental conditions can range from -55 to 155°C (-67 to 311°F). The rapid and continuous insertions and removals involved place extreme mechanical demands on the socket so that dimensional stability, wear, and compression all become issues. If the dimensional stability of the BiTS substrate is not sufficient, the holes can become misaligned with the pins of incoming devices, a situation that will quickly create havoc. Built-in stress, moisture absorption, and temperature changes are two leading causes of BiTS movement.

## Material Options

Many pragmatic factors bear on the selection of material from which to fabricate a socket. This is especially true for the more demanding requirements imposed by smaller and smaller pitch geometries as are common in MPU's and video graphics.

For many years, a primary material of choice for test sockets has been polyimide. This material offers excellent stability, wear rates, and electrical performance across a broad temperature range. At one time, virtually all BiTS were made from polyimide (typically Vespel SP-1). ***Today, Professional Plastics offers both Vespel® and Meldin® polyimide shapes used for back-end testing applications.*** Meldin provides cost and yield improvements which could once again make polyimide a viable option for new applications.

If the socket will be used for burn-in, it obviously must have long-term thermal stability to maintain mechanical, electrical, and dimensional properties. The first two are given by data such as continuous-use temperature rating (CUTR), which indicates the maximum temperature at which a plastic will maintain tensile strength and electrical properties after 100,000 hr. These data may be found in sources such as the UL Yellow Card listing.

For a test socket, the temperatures are usually not as high nor are the durations of exposure as long. Here, factors such as coefficient of linear thermal expansion (CLTE) predict the amount of expansion and contraction expected from temperature changes. If the tolerances are extremely tight, the closer this value is to that of the silicon wafer or chip, the more accurately the hole alignment, which can be maintained. The CLTE may or may not be linear over all temperature ranges, especially crystalline materials where it increases at the glass-transition temperature ($T_g$).

Devices can be pressed onto the surface of the socket with a significant amount of force. So it's best to use a substrate with high compressive strength to better resist the spot pressures and minimize the formation of grooves. Dynamic mechanical analysis (DMA), a technique that measures the modulus as a function of temperature, shows that the modulus for a crystalline polymer (PPS, PEEK) drops significantly at the $T_g$ whereas amorphous polymers (PEI, PAI, PI, or PBI) exhibit more linear change through higher temperatures.

The addition of reinforcing glass or carbon fibers improves both the CLTE and DMA data for crystalline materials, more so than for amorphous ones. Cleanliness of the materials is also important as much of the testing takes place in clean rooms. Candidate BiTs materials must have minimal particle generation and outgassing at elevated temperatures. PAI boasts the highest strength to 260°C (500°F) and is dimensionally stable with a CLTE of 1.7 X $10^{-5}$. It maintains 70% of its flexural strength when tested at 150°C (300°F).

Both PPS and PEEK are crystalline-advanced engineering polymers. PPS has strength combined with good heat and chemical resistance (no known solvents below 200°C (392°F). PPS absorbs essentially no moisture and has a low CLTE. PEEK offers chemical and hydrolysis resistance similar to PPS, but can operate at higher temperatures. Its continuous-use temperature is 250°C (480°F). However, the stiffness of PEEK drops off significantly and expansion rate



increases above its $T_g$ of 150°C (300 °F). The introduction of CeramaPEEK® NC30 helps address these issues. CeramaPEEK® is an advanced PEEK compound created to meet the requirements for tight tolerance, high frequency IC chip socket test fixtures. CeramaPEEK® NC30 is white in color and provides improved hole stability and cleanliness. Precision holes drilled into CeramaPEEK® NC30 are burr-free (when machined properly) and provide longer life than competing materials.

## Static Control

New high-density chips can also be quite sensitive to static charge. The socket material must not generate static charges and must safely dissipate any incoming static without destructive discharges.

A static dissipative PEI family called Semitron ESd has good mechanical performances to 275°C (525°F), can dissipate static charges of 5 kV in less than 2 sec, and has low molded-in stress which gives machined parts tight tolerances. There are several grades of Semitron ESd materials, whose choice depends on the combination of surface resistivity and required temperature.

Designers of semiconductor consumables are relying more and more on advanced machinable plastics to put 0.5-mm and finer-pitch ICs through their paces during back-end testing. One of the key properties for test sockets devices is ESd protection. Also important is mechanical strength, plus dimensional stability over the full range of temperature and environmental conditions. These properties let materials withstand significant insert loads over –65 to 311°F, a typical requirement for test sockets. Although the initial targets were higher, most fabs now want the surface resistivity to be between 1 X $10^6$ and 1 X $10^9$Ω/sq to provide decay rates of <0.1 sec. This helps ensure that the device will not be damaged by stray discharges during movement and testing in a socket.

The newest generation test sockets have added protection from static discharge by incorporating new static-dissipative (ESD) materials. From a material standpoint, ESD protection is usually discussed in terms of surface resistivity and/or discharge rates. Surface resistivity (for electric current flowing across a surface) is the ratio of DC voltage drop per unit length to the surface current per unit width. It in effect is the resistance between two opposite sides of a square and is independent of the size of a square or its dimensional units. Surface resistivity is expressed in Ω/square.

Using the CLTE, engineers can predict how much expansion and contraction to expect during testing in test sockets used to evaluate 0.5-mm-pitch ICs. The extremely tight tolerances needed for the 0.5-mm-pitch ICs dictate socket materials have a CLTE close to that of the silicon chip. That's because the closer the CLTE match, the more accurately holes in the socket stay lined up during testing at temperature extremes.

In some environments where humidity is high and poorly controlled, some polymers see a lot of dimensional change due to moisture absorption. It's too much for small, high precision parts such as sockets. This is particularly true for test sockets used in testing next-generation fine-pitch chips. We offer several new grades of low-moisture-absorbing materials. These materials offer ESD protection at least equivalent to current ESD materials and are dimensionally stable over the entire temperature range (–65 to 311°F).

Semitron ESd 420V, is based on PEI (polyetherimide). Its proprietary reinforcement technology provides high strength and stiffness to withstand high chip-insertion forces with no deflection. It also improves upon the overall stability of Quadrant's current PEI-based ESD materials and offers surface resistivity of 1 X $10^6$ and 1 X $10^9$Ω/sq. With a heat-deflection temperature of 420°F, the material provides a more cost-effective, high-strength alternative to other ultra-high-temperature resistant materials. Furthermore, unlike crystalline materials in which the CLTE rises two to threefold at the glass-transition temperature, Semitron ESd 420V maintains its low CLTE to over 400°F. This is a significant advantage in maintaining dimensional stability and mechanical strength of a test socket throughout the full test temperature range.

In addition, the company has developed a new reinforced PEEK (polyetheretherketone) called Semitron ESd 480. The material also has a surface resistivity of 13 x $10^6$ and 1 X $10^9$Ω/sq, but its heat-deflection temperature is 480°F. Its chemical resistance makes it suitable for wafer handling and other structural applications in wet process tools where static dissipation is important.

A major advantage of Semitron ESd 420V and 480 is that they maintain their dielectric performance even after repeated exposures to high voltages. In contrast, other typical carbon-fiber-enhanced products suffer dielectric breakdown and become irreversibly more conductive when exposed to moderate voltage. Thus they can't ensure continued ESD protection to the wafer or device. The new materials are also nonsloughing, and thus minimize contamination. This makes them ideal for machined nests, sockets, and contactors for test equipment and other electronic device handling and testing components.

## High Temperature Alternatives

In addition to polyimide, there are a wide variety of unfilled and glass-fiber-filled materials which have proven as successful alternatives & which provide solutions of their own. Torlon® PAI (polyamide-imide) thanks to the latter's lower coefficient of linear-thermal expansion (CLTE) is one such material. Lower CLTE gave the sockets better dimensional stability, longer wear, and lower cost. Professional Plastics offers two proven PAI solutions: Torlon® 4203 (unfilled PAI), and Torlon® 5530 (30% glass-filled PAI). In addition to these materials, we offer alternatives when cost is a more primary factor than maximum top-end performance. These material options include: Ultem® 1000 (unfilled polyetherimide), Ultem® 2300 (30% glass-filled polyetherimide), PEEK 450 (unfilled polyetheretherketone), PEEK GF30 (30% glass-filled polyetheretherketone), and PEEK CF30 (carbon-filled polyetheretherketone).

* Note: Portions of the information contained herein are provided courtesy of Quadrant EPP.

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Professional Plastics has delivered the highest quality of high-performance engineering plastics, at the best prices, to loyal customers since 1984. With 17 locations in US and Asia, we ensure the fastest service from our warehouse to your doorstep.

## Vespel® SP-1 Polyimide

Vespel SP-1 offers a broad combination of temperature resistance, chemical resistance, mechanical toughness, natural lubricity, wear-resistance and insulation properties. Vespel SP-1 parts provide operating temperatures from cryogenic to 300°C (570°F), great plasma resistance, plus a UL rating for minimal electrical and thermal conductivity.

**Specifications**
ASTM-D 6456-99 Type 1
AMS 3644 Class 1
Mil-R-46198 Type 1

- Performs at continuous service to 570°F
- Does not melt at any temperature
- Ultra low outgassing & excellent wear properties

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .062" - 2.000" | 5" x 5"<br>5" x 10"<br>10" x 10" |
| Rods | .125" - 3.250" dia. | 9.5"<br>38" |

Vespel® is a registered trade name of E.I. DuPont DeNemours.

## Meldin® 7001 Polyimide

Meldin 7001 polyimide shapes offer superior mechanical properties & high chemical resistance. Meldin is ideal for electrical and thermal insulating applications. More ductile than ceramics, and lighter weight than metals, Meldin 7001 is an excellent choice for structural parts in applications where metal replacement is desirable. In I.C. Testing applications, Meldin 7001 is an excellent replacement for Vespel SP-1. Meldin 7001 is suitable for high-temperature, high stability semiconductor applications.

**Specifications**
ASTM D6456-99 Type 1
AMS3644 Class 1
Mil-R-46198 Type 1 (old)
Honeywell MCS5016 Type 1

- Operates from cryogenic to 315°C (600°F) & intermittently to 482°C (900°F)
- Continuous operational temperatures of 260°C (550°F)
- Does NOT melt
- Self-lubricating properties
- Plasma etch rate is 10 to 20% lower than Vespel SP-1
- 12" x 12" Meldin Plates have 44% MORE material than a 10" x 10" Vespel plate

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .062" - 2.000" | 6" x 6"<br>6" x 12"<br>10" x 10"<br>12" x 12" standard |
| Rods | .125" - 3.250" dia. | 12"<br>38" |

## Semitron® ESd 420v PEI (Ultem)

Semitron ESd 420V is a stiff, high strength material that is not subject to dimensional change as a result of exposure to moisture. It is also a cost effective alternative for applications that do not require the thermal performance of ultra-high performance materials.

- High strength and stiffness
- Surface resistivity of $10^6$ to $10^9$ Ω/sq
- Heat deflection temperature of 215°C (419°F)
- Cost effective, high strength alternative to ultra high temperature resistant materials

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.250" | 12" x 12"<br>12" x 24"<br>14" x 28" |

## Semitron® ESd 500HR - ESd PTFE

Semitron ESd 500HR (white) is a static dissipative PTFE. Reinforced with a proprietary synthetic mica, Semitron ESd 500HR offers an excellent combination of low frictional properties, good dimensional stability and electrostatic dissipation. Whenever virgin PTFE causes electrical discharge problems, Semitron ESd 500HR will provide a controlled bleed-off of static charges while maintaining typical PTFE-properties such as broad chemical resistance and low coefficient of friction.

- Inherently dissipative and does not rely on atmospheric phenomena (e.g. humidity) to activate, nor are surface treatments used to achieve dissipation
- Since Semitron ESd 500HR does not contain carbon or graphite powder to provide electrostatic dissipation, sloughing is not a problem
- Broad chemical resistance
- Low coefficient of friction

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.250" | 12" x 12"<br>12" x 24"<br>14" x 28" |



*Not all sizes shown. For the most up to date information please inquire by phone.

## CeramaPEEK® Ceramic-Filled

CeramaPEEK NC30 EXTRUDED Test Socket Material is an advanced proprietary ceramic-filled PEEK compound created to meet the requirements for tight tolerance, high frequency IC chip socket test fixtures. CeramaPEEK NC30 is the advanced version of our ceramic-filled PEEK. This version is WHITE in color and provides even better hole stability and cleanliness. Precision holes drilled into CeramaPEEK NC30 Test Socket Material are burr-free (when machined properly) and provide longer life than competing materials. CeramaPEEK NC30 is offered exclusively by Professional Plastics to IC Test Socket manufacturers worldwide.

- **Exceptional Dimensional Stability**: low moisture absorption, low creep, high modulus, metal-like CLTE, low coefficient of hygroscopic expansion
- **Machinable to Very Tight Tolerances**: low burring, compatible with tight pitch and fine diameter holes
- **Good Abrasion Resistance and Ductility**: maintains tolerances after 100,000 chip insertions, good impact properties
- **Very Stable Electrical Properties**: low moisture absorption and intrinsically good electrical insulator
- **Thermal Stability**: compatible with wide temperature range, maintains physicals with after heat aging
- **Economical**: more economical than competing injection-molded products

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .250" - 1.000" | 24" x 48" |

Also available in .150" x 3.00" x 5.25" injection molded blanks.

## PEEK - Virgin Grade

PEEK is an abbreviation for PolyEtherEther-Ketone, a high performance engineering thermoplastic. PEEK grades offer chemical and water resistance similar to PPS (PolyPhenylene Sulfide), but can operate at higher temperatures. PEEK can be used continuously to 480°F (250°C) and in hot water or steam without permanent loss in physical properties. For hostile environments, PEEK is a high strength alternative to fluoropolymers. PEEK carries a V-0 flammability rating and exhibits very low smoke and toxic gas emission when exposed to flame.

- Excellent chemical resistance
- Very low moisture absorption
- Inherently good wear and abrasion resistance
- Unaffected by continuous exposure to hot water or steam
- Available in Victrex® PEEK produced exclusively by Victrex
- Available in Vestakeep® PEEK produced exclusively by Evonik Degussa

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .250" - 2.000" | 12" x 12"<br>12" x 24"<br>24" x 24"<br>24" x 48" |
| Rods | .250" - 4.000" dia. | |

## Semitron® ESd 480 ESd PEEK

Semitron ESd 480 is static-dissipative, carbon fiber reinforced PolyEtherEtherKetone for use where the properties of PEEK are needed, but protection from static discharge is a requirement. For an ever tighter ESd range, consider Semitron ESd 490 ($10^9$ to $10^{10}$ ohms/sq). This material is black in color.

- Has a surface resistivity of 13 x $10^6$ and 1 x $10^9$ Ω/sq
- Heat-deflection temperature is 480°F
- Its chemical resistance makes it suitable for wafer handling and other structural applications in wet process tools where static dissipation is important
- CLTE is 1.7 X $10^{-5}$ in/in/°F

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.250" | 12" x 12"<br>12" x 24"<br>14" x 28" |

## Semitron® ESd 490HR ESd PEEK

Semitron ESd 490HR is a static dissipative reinforced PolyEtherEtherKetone (PEEK). This material has similar general properties as Semitron ESd 480, but a higher resistivity value and offers high structural strength and stiffness combined with excellent dimensional stability.

Semitron ESd 490HR is also non-sloughing to minimize contamination due to wear so it is ideal for making nests, sockets and contactors for test equipment and other electronic device handling components. While typical carbon-fiber-enhanced products become irreversibly more conductive when exposed to moderate voltage, Semitron ESd 490HR maintains its dielectric performance while maintaining its mechanical properties.

- Higher resistivity value, in the range of $10^9$ to $10^{11}$ Ω/sq
- Thermally stable to temperatures of 490°F (270°C)
- Excellent chemical resistance

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.250" | 12" x 12"<br>12" x 24"<br>14" x 14"<br>14" x 28" |

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## Semitron® ESd 410C Conductive Ultem®

Semitron ESd 410C (black) is a static dissipative/conductive PEI. Having an excellent mechanical performance up to 210°C, Semitron ESd 410 provides ESd solutions at higher temperatures. This material is ideal for handling equipment in the semiconductor industry, specifically IC Test Sockets, Nests and Handlers.

- Surface resistivity of 1 X $10^4$ and 1 X $10^6$ Ω/sq
- Excellent mechanical performance up to 210°C
- Exhibits dimensional stability, low coefficient of linear thermal expansion, and small water absorption
- Inherently dissipative and does not rely on atmospheric to activate

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 2.000" | 12" x 12"<br>12" x 24"<br>14" x 28" |
| Rods | .375" - 3.000" dia. | |

## Semitron® ESd 420 - (ESd Ultem®)

Semitron ESd 420 - Static Dissipative PEI is the only, truly dissipative plastic product for use in high temperature applications. ESd 420 has a unique combination of properties: static dissipation, low coefficient of expansion, high strength and heat resistance and is non-sloughing. ESd 420 has a tensile modulus of 550,000 psi, a heat deflection temperature (at 264 psi) of 420°F. Semitron ESd 420 is also ideal for use in equipment for handling components in the hard-drive manufacturing and assembly processes.

- Surface resistivity in the intermediate range of 1 X $10^6$ and 1 X $10^9$ Ω/sq
- Low coefficient of thermal expansion, high compressive strength and good wear resistance
- High strength and stiffness at temperatures up to 420°F
- Very low residual stresses and as a result can be machined very flat and to very tight tolerances

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 2.000" | 12" x 12"<br>12" x 24"<br>14" x 28" |

## Ultem® 1000 Polyetherimide

Ultem 1000 (standard, unfilled polyetherimide) offers excellent chemical resistance, high dielectric strength, natural flame resistance, and extremely low smoke generation. Ultem's exceptionally high mechanical properties and ease of fabrication including bonding make it an easy choice when exceptional performance is required.

- Suface resistivity is > $10^{13}$ Ω/sq
- High strength and performs in continuous use to 340°F (170°C)
- 94-V-0 rated with low smoke KPSI
- Also available in glass-filled

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .250" - 1.250" | 12" x 12"<br>12" x 24"<br>24" x 24"<br>24" x 36"<br>24" x 48" (standard) |
| Rods | .250" - 8.000" dia. | 96" |

## Ultem® 2300 - 30% Glass-Filled

Ultem 2300 PEI is an extruded 30% glass reinforced polyetherimide that is commonly machined into parts for electrical/electronic insulators. It is ideal for high strength/high heat applications, and those requiring consistent dielectric properties over a wide frequency range. This material provides greater rigidity and improved dimensional stability while maintaining many of the useful characteristics of unfilled Ultem.

- Performs continuously to 340°F (171°C)
- Exceptional flame and heat resistance
- High-strength & high stability
- Hydrolysis resistant
- Highly resistant to acidic solutions
- Capable of withstanding multiple autoclaving cycles

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .500" - 2.000" | 24" x 24"<br>24" x 48" |
| Rods | .250" - 8.000" dia. | 96" |



*Not all sizes shown. For the most up to date information please inquire by phone.

## Torlon® 4203

Torlon polyamide-imide offers excellent compressive strength and the highest elongation of the Torlon grades. It also provides electrical insulation and exceptional impact strength. This Torlon grade is commonly used for IC Test Sockets & Handlers, as well as, electrical connectors and insulators due to its high dielectric strength. Its ability to carry high loads over a broad temperature range makes it good for structural components such as linkages and seal rings. Torlon 4203 is also an excellent choice for wear applications involving impact loading and abrasive wear.

- Torlon 4203 is brown in color
- Very high compressive & impact strength
- Tremendous insulation properties & high dielectric strength

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .187" - 1.500" | 12" x 12"<br>12" x 48" |
| Rods | .093" - 2.000" dia. | 96" |

## Torlon® 5530

Quadrant's compression-molded version of Solvay Torlon 5030 PAI injection-molding resin. The compression-molding process creates a random dispersement of the glass fibres which in-turn allows for tremendous dimensional stability in all directions. In addition, Torlon 5530 is electrically insulative with a surface resistivity of > $10^{13}$ Ω/sq. It has exceptional dielectric strength over 800-volt/mil. It offers best-in-class radiation resistance, withstanding exposure to 10 x 9th rads. Close tolerance components are produced from 5530 including IC Test Sockets, Handlers & Nests welding tip insulators, CVT clutch rollers, fasteners, igniter cups & cases, gears, splines, hydraulic poppets and many other structural and dynamic components.

- Incredible dimensional stability in all directions
- Electrically insulative
- Perfect for IC Test Sockets, Nests & Handlers

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.500" | 12" x 12"<br>12" x 24"<br>14" x 28" |
| Rods | 1.625" - 10.000" dia. | |

## Torlon® 4XG - Extruded (30% G/F)

Torlon 4XG PAI is a 30% glass-reinforced PAI (polyaminde-imide). It offers high rigidity, retention of stiffness, a low expansion rate and improved load carrying capabilities. This grade is well suited for applications in the electrical/electronic, business equipment, aircraft and aerospace industries. Torlon 4XG is the extruded version of Torlon 5030, as made by Quadrant EPP.

- Glass reinforced for improved load capacity
- Extremely rigid
- Extruded which allows longer lengths

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .187" - .375" | 24" x 48" |

## Semitron® ESd 520HR - ESd PAI

An industry first combination of electrostatic dissipation (ESd), high strength and heat resistance. This new ESd material is ideal for making nests, sockets and contactors for test equipment and other device handling components. The key feature of 520HR is its unique ability to resist dielectric breakdown at high voltages (>100V). Typical carbon fiber enhanced products become irreversibly more conductive when exposed to even moderate voltage.

- Surface Resistivity: $10^{10}$ to $10^{12}$ Ω/sq
- High temperature range
- Extremely stable
- Can be machined to extremely tight tolerances.
- Designed for use as IC Test Sockets, Nests & Handlers

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .375" - 1.500" | 12" x 12"<br>12" x 24"<br>14" x 28" |

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## Semitron® MDS 100

Semitron MDS 100 is a strong, stiff platform for applications such as: Test sockets for semiconductor test and package equipment, fixtures for electronics testing, mounting points for precision diagnostic equipment, positioning platforms for miniature motion control devices. With a flexural modulus (ASTM D790) in excess of 1,400,000 psi and extremely low moisture absorption (24 hr., ASTM D570) of .10%, Semitron MDS 100 delivers performance that solves engineering problems associated with uncontrolled application environments. Its low coefficient of linear thermal expansion (ASTM E831) of 1.1 x $10^{-5}$ also contributes to its remarkable stability. The heat deflection or softening temperature (ASTM D648) is 410° F (210° C).

- Low coefficient of linear thermal expansion
- Extremely low moisture absorption
- Thermal performance to 410°F (210°C)

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .039" - .393" | 9.84" x 9.84"<br>19.69" x 19.69" |

## Semitron® MP 370

Semitron MP 370 offers more choices in the design and manufacture of precision test sockets for the semiconductor manufacture industry. While maintaining the same excellent moisture absorption and high thermal resistance of PEEK, Semitron MP 370 provides greater strength and dimensional stability. This custom formulation allows finer and cleaner detail due to it's excellent machinability.

- Very low moisture absorption
- Exceptional machinability - very small holes and tight hole patterns are possible
- Strength and stiffness that exceed unfilled PEEK materials
- Low internal stresses and no "soft center" problems associated with injection molded blanks

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .250" - 2.000" | 12" x 12"<br>12" x 48"<br>24" x 48" |

## Techtron® PPS

Techtron PPS offers the broadest resistance to chemicals of any advanced engineering plastic. They have no known solvents below 392°F (200°C) and are inert to steam, strong bases, fuels and acids. Minimal moisture absorption and a very low coefficient of linear thermal expansion, combined with stress-relieving manufacturing, make PPS ideally suited for precise tolerance machined components. Sockets made from Techtron PPS are used during high-power/high-speed testing of semiconductor packages.

- No known solvents below 392°F (200°C)
- Inert to steam, strong bases, fuels and acids
- Minimal moisture absorption
- Very low coefficient of linear thermal expansion

| Products | Thickness | Dimensions |
|---|---|---|
| Sheets | .250" - 2.000" | 12" x 48"<br>24" x 48" |
| Rods | .250" - 5.000" dia. | |


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QUADRANT

Portions of product information and images provided by Quadrant Engineering Plastic Products.

**(800) 966-PROS 7767**

*Not all sizes shown. For the most up to date information please inquire by phone.

| Property | Units | Test Method ASTM | Vespel® SP-1 Polyimide | Meldin® 7001 Polyimide | Torlon® 4203 | Torlon® 5530 | Semitron® ESd 410C | Semitron® ESd 420 ESd PEI | Semitron® ESd 480 ESd PEEK | Semitron® ESd 490HR ESd PEEK | Semitron® ESd 520HR ESd PAI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Specific Gravity** | $g/cm^3$ | D-792 | **1.43** | **1.43** | **1.41** | **1.61** | **1.41** | **1.34** | **1.47** | **1.5** | **1.58** |
| **Tensile Strength, 73 F** | psi | D-638 | **12,500** | **12,500** | **18,000** | **15,000** | **9,000** | **11,500** | **14,500** | **14,000** | **12,000** |
| **Tensile Modulus of Elasticity, 73 F** | psi | D-638 | **-** | **-** | **600,000** | **900,000** | **850,000** | **640,000** | **940,000** | **940,000** | **800,000** |
| **Tensile Elongation, 73 F** | % | D-638 | **7.5** | **7.5** | **10** | **3** | **2** | **2** | **1.5** | **2.3** | **3** |
| **Flexural Strength 73 F** | psi | D-790 | **15,900** | **15,900** | **24,000** | **20,000** | **12,000** | **14,500** | **21,000** | **21,000** | **20,000** |
| **Flexural Modulus of Elasticity, 73 F** | psi | D-790 | **450,000** | **450,000** | **600,000** | **850,000** | **850,000** | **650,000** | **1,000,000** | **950,000** | **850,000** |
| **Shear Strength, 73 F** | psi | D-732 | **13,000** | **13,000** | **16,000** | **-** | **9,000** | **8,020** | **-** | **-** | **12,600** |
| **Com-pressive Strength** | psi | D-695 | **19,300** | **19,300** | **24,000** | **27,000** | **19,500** | **23,800** | **26,500** | **26,000** | **30,000** |
| **Com-pressive Modulus of Elasticity, 73 F** | psi | D-695 | **350,000** | **350,000** | **478,000** | **600,000** | **600,000** | **370,000** | **570,000** | **600,000** | **600,000** |
| **Hardness, Rockwell, 73 F** | - | D-785 | **E45-60** | **E45-60** | **E80 (M120)** | **E85 (M125)** | **M115 (R125)** | **M118** | **M107 (R122)** | **M105 (R123)** | **M108** |
| **Coefficient of Linear Thermal Expansion** | in/in/F | D-696 | **$5.1 \times 10^{-5}$** | **$5.1 \times 10^{-5}$** | **$1.7 \times 10^{-5}$** | **$2.6 \times 10^{-5}$** | **$1.8 \times 10^{-5}$** | **$1.95 \times 10^{-5}$** | **$1.7 \times 10^{-5}$** | **$2.8 \times 10^{-5}$** | **$2.8 \times 10^{-5}$** |
| **Deflection Temperature 264 psi** | F | D-648 | **680** | **680** | **532** | **520** | **410** | **410** | **500** | **500** | **520** |
| **Melting Point** | F | D-789 | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **644** | **644** | **N/A** |
| **Continuous Service Temp. in Air (Maximum)** | F | - | **550** | **550** | **500** | **500** | **338** | **340** | **475** | **475** | **500** |
| **Dielectric Strength, Short Term** | V/mil | D-149 | **560** | **560** | **580** | **700** | **N/A** | **-** | **-** | **-** | **475** |
| **Dielectric Constant, 60 Hz** | - | D-150 | **3.55** | **3.55** | **4.2** | **6.3** | **3** | **5.63** | **-** | **<2 sec** | **5.76** |
| **Water Absorbtion 24 hrs** | % | D-570 | **0.24** | **0.24** | **0.40** | **0.30** | **0.30** | **0.50** | **0.18** | **0.18** | **0.60** |
| **Water Absorption Saturation** | % | D-570 | **0.72** | **0.72** | 1.70 | **1.50** | **1.10** | **2.90** | **1.65** | **1.65** | **4.60** |
| **Surface Resistivity at 50% RH** | Ohms/sq | D-257 | **$10^{14}$- $10^{15}$ Ω/sq** | **$10^{14}$- $10^{15}$ Ω/sq** | **> $10^{16}$ Ω/sq** | **> $10^{13}$ Ω/sq** | **$10^4$ 1 - $10^6$ Ω/sq** | **$10^6$- $10^9$ Ω/sq** | **$10^6$- $10^9$ Ω/sq** | **$10^9$- $10^{11}$ Ω/sq** | **$10^{10}$- $10^{12}$ Ω/sq** |

# PRODUCT COMPARISON

| PEEK Virgin | CeramaPEEK® Ceramic-filled PEEK | Techtron® PPS | Ultem® 1000 Un-filled PEI | Ultem® 2300 30% GF PEI | Semitron ESd 420v | Semitron ESd 500HR | Torlon 4XG | Semitron MDS 100 | Semitron MP 370 |
|---|---|---|---|---|---|---|---|---|---|
| 1.32 | 1.51 | 1.35 | 1.27 | 1.51 | 1.51 | 2.3 | 1.6 | 1.51 | 1.62 |
| 14,500 | 13,000 | 13,500 | 15.2 | 17,000 | 10,000 | 1,450 | 23,000 | 14,700 | 11,500 |
| 490,000 | 650,000 | 500,000 | 430,000 | 800,000 | 910,000 | 210,000 | 1,000,000 | 1,500,000 | 640,000 |
| 50 | - | 15 | 60 | 3 | 1.5 | 4 | 4 | 1.5 | 3 |
| 24,600 | 23,000 | 21,000 | 21,000 | 30,000 | 15,800 | 2,030 | 30,000 | 20,500 | 16,750 |
| 590,000 | 650,000 | 575,000 | 480,000 | 900,000 | 910,000 | 500,000 | 980,000 | 1,420,000 | 625,000 |
| 7,690 | - | 9,000 | 15,000 | - | - | - | - | 12,000 | 11300 |
| 20,000 | 17,000 | 21,500 | 20,300 | 32,000 | 22,300 | 4,000 | 40,000 | 24,400 | 18,200 |
| 450,000 | - | 430,000 | 420,000 | 620,000 | 545,000 | 250,000 | 700,000 | - | 600,000 |
| R126 | - | M95 (R125) | M109 | M114 (R127) | M110 (E78) | R50 | E90 | R121 | M98 |
| $2.6 \times 10^{-5}$ | $2.0 \times 10^{-5}$ | $2.8 \times 10^{-5}$ | $3.45 \times 10^{-5}$ | $1.1 \times 10^{-5}$ | $1.5 \times 10^{-5}$ | $5.7 \times 10^{-5}$ | $.9 \times 10^{-5}$ | $1.1 \times 10^{-5}$ | $2.5 \times 10^{-5}$ |
| 320 | > 500 | 250 | 392 | 410 | 420 | 212 | - | 410 | 300 |
| 640 | - | 540 | - | - | N/A | 621 | N/A | 635 | 480 |
| 480 | - | 425 | 340 | 340 | 340 | 500 | 500 | 480 | - |
| 480 | 400 | 540 | 830 | 770 | - | 390 | 700 | 362 | 376 |
| 3.2 | 3.5 | 3 | 3.15 | 3.7 | - | 2.9 | - | 3.37 | 4.13 |
| 0.15 | 0.20 | 0.01 | 0.25 | - | 0.21 | .10 | 0.30 | 0.10 | 0.11 |
| 0.50 | - | 0.03 | 1.25 | - | 1.40 | 2.0 | 1.50 | - | 0.50 |
| $> 10^{13}$ Ω/sq | $> 10^{13}$ Ω/sq | $> 10^{13}$ Ω/sq | $> 10^{13}$ Ω/sq | $3 \times 10^{16}$ Ω/sq | $10^{6}$- $10^{9}$ Ω/sq | $10^{10}$- $10^{12}$ Ω/sq | $> 10^{16}$ Ω/sq | $> 10^{13}$ Ω/sq | $> 10^{13}$ Ω/sq |

The information contained herein is based on typical properties and values for reference and comparison purposes only. This information should not be used as the sole basis for design and specification. Furthermore, it should not be used as a basis for quality control or considered as minimum performance characteristics. Actual data may vary. All values at 73˚F (23˚C) unless otherwise noted.

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130104 Printed in the U.S.A.