



Linking Innovators & Entrepreneurs

# TECHLINK™ OPPORTUNITY

Advanced Technology Available for License

A NON-CONFIDENTIAL SUMMARY

## DM-111 — IMIDE-EXTENDED BISMALIMIDE RESINS

### BENEFITS

**Temperature Stability** — >400° C (dynamic TGA).

Stable in very-high-heat applications, well above competing thermosets.

**Hydrophobicity** — Moisture uptake as low as 0.2%.

Properties remain stable in hot/wet conditions.

**High Flexibility** — **Enhanced adhesion.** Can be processed into film adhesives with superior peel strength, temperature stability & hydrophobicity.

**Curing Options** — **UV, thermal (w/ curatives or w/o), or free radical.**

Permits broad application flexibility, use-dependent.

**Easy Formulation** — **Flexible molecular configuration.** Permits significant custom-tailoring of molecules by adding aliphatic, aromatic or siloxane moieties

**Tailorable Modulus** — **Use-defined.** Modulus can be easily modified by design.

### WHY IS IT UNIQUE?

Existing bismaleimide resins are brittle and hydrophilic. Imide-extended bismaleimides offer scalable flexibility, excellent peel strength and reduced moisture sensitivity.

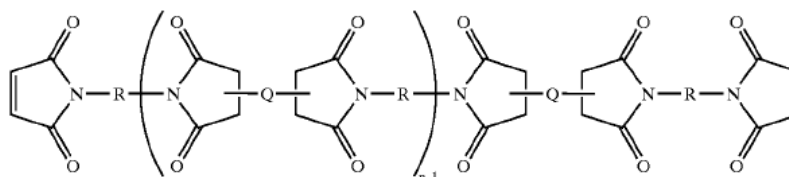
This completely novel set of imide-extended bismaleimide adhesive resins provides outstanding temperature-stability and hydrophobicity — *without brittleness*. These resins are stable at normal shipping and storing temperatures, and they can be cured thermally (Ene/Diels-Alder, Michael addition, free radical), or via UV photoinitiation.

### Technology Background:

Bismaleimide compounds have long been recognized as effective resins in high performance adhesive compositions, especially in semiconductor fabrication. Bismaleimides can be cured [polymerized] through heat as stand alone monomers (with or without free radical initiators) or in combination with curatives such as polyallyl or propenyl functional aromatic compounds. They may also be thermally cured with poly-thiol or amine functional compounds, or optionally cured via UV photoinitiation. Once cured, bismaleimide compounds exhibit good mechanical strength, high modulus, and excellent resistance to thermal degradation. The major drawback of available bismaleimides, however, is that they are very brittle, which significantly reduces their suitability for many applications. The commercial bismaleimides are also noted for their high moisture affinity. The Next-Generation formulations offered here provide the desired temperature stability and hydrophobicity, but without the brittleness.

### Technology Description:

The general composition of IXBMI resins is:



Where “Q” and “R” are each independently substituted or unsubstituted aliphatic, aromatic or siloxane moieties. The substitutions made can be used to tweak the properties of these resins for different desirable characteristics and applications. For example, either “Q” or “R” may be a flexible or rigid moiety, or a combination of both.

When the terminal maleimide is attached to an aliphatic “R” group, the addition of vinyl ether comonomers can result in a photo curable composition without the need for addition of separate photoinitiators.

These compositions can be formulated with fillers, catalysts, inhibitors, and coupling agents to make a fully formulated adhesive package. Since the matrix of these compositions is thermoplastic, no settling will occur during shipping or storage. These characteristics permit packaging shipment and storage without refrigeration. These properties facilitate forming adhesives into various shapes and sizes for ease of use.



### ADDITIONAL NON-CONFIDENTIAL INFORMATION

- Copies of issued patents and published patent applications
- Copies of published articles on uses/applications of bismaleimide

### ADDITIONAL CONFIDENTIAL INFORMATION

*[available under Secrecy or Evaluation Agreement]*

- Copies of claims from unpublished patent applications
- Copies of test results and molecule characterization & performance
- Detailed listing of available foreign filings
- Molecular-structure consulting and samples by arrangement

### FOR ADDITIONAL INFORMATION, OR TO DISCUSS COMMERCIAL TERMS, CONTACT:

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Please refer to Case Number:  
**DM-111**

### TECHNOLOGY APPLICATIONS

The Imide-Extended Bismaleimide molecule is extremely versatile, permitting independent substitution of aliphatic, aromatic or siloxane moieties at either of two junction points. Such substitutions can be used to tweak the properties of these resins for desirable characteristics and applications. For example, photo curable compositions can be made without the need for addition of separate initiators. Adhesive applications include superior metal bonding and heat stability to as high as 400° C (dynamic TGA), important in construction, aerospace and automotive markets, plus many more. They may also be used for fillers and film applications. Additional applications include:

- Automotive applications such as brake pads, metal bonding
- Space applications such as attaching tiles/coatings to re-entry vehicles
- Internal coating of corrosive/volatile chemical holding or processing tanks, control valves and pumps
- Attaching internal brick coatings to ovens, boilers and kilns
- Scratch-resistant coatings for optics, stovetops, tools and other abrasion-prone surfaces

### INTELLECTUAL PROPERTY

These compositions are covered by US patent 7,157,587, as well as US patent application 2004/0225026 [notice of allowance issued], and numerous additional pending patent applications.

### STAGE OF DEVELOPMENT

This technology is NOT experimental; functional batches of multiple moieties have been produced, and their technical performance characterized. Additional moieties can easily be produced in small batches for additional testing. The chemistry is straight-forward, using readily available precursors, and the originating company is available for consultation and technical support in adapting the technology to the specific needs of individual licensees.

### COMMERCIAL RIGHTS AVAILABLE

This technology and its patents rights are available for license on a nonexclusive or field-of-use exclusive basis in all fields except semiconductor packaging and anisotropic film applications, which fields have already been licensed.