QPAC® is available in a variety of forms, including granulates, pellets, aqueous dispersion and solutions. If you would like more information or would like to discuss a specific application, contact us at:

TYPICAL INDUSTRIES WE SERVE:

- **Electronic Passive Components**
- **Brazing Pastes**
- **Technical Glass**
- **Fuel Cells**
- **Tooling Manufacturers**
- **MEMS**

100 Interchange Boulevard
Newark, DE 19711
Telephone: 302.452.6600
Email: customerservice@empowermaterials.com
Website: www.empowermaterials.com

EMPOWER MATERIALS

QPAC®

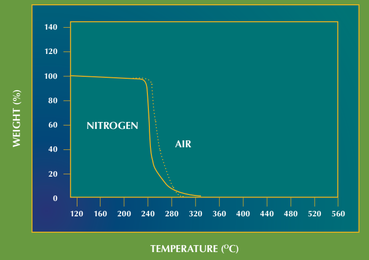
CO_2 based polymers for a cleaner, more demanding world.

EMPOWER MATERIALS

EMPOWER MATERIALS is the producer of QPAC®, the world's cleanest thermally decomposable binder. QPAC® cleanly decomposes into CO_2 and water in many types of atmospheres and leaves virtually no residue. This property contributes to QPAC®'s widespread usage in many demanding applications.

QPAC® poly(alkylene carbonate) copolymers are a unique family of innovative thermoplastics representing a true break-through in polymer technology. While traditional plastics have been primarily petroleum based, these materials are derived from carbon dioxide and are produced through the copolymerization of CO_2 with one or more epoxides. The resultant polymers are amorphous, clear, readily processible, and have long-term mechanical stability. They are also environmentally friendly by consuming 50% fewer petrochemicals, as compared to other polymers which are 100% petrochemical based. In addition, they may exhibit biodegradable properties consistent with an environmentally friendly binder.

Thermogravimetric analyses in both air and nitrogen show complete decomposition of poly(propylene carbonate) at low termperatures, heating rate is 10°C/minute.



QPAC® 25, polyethylene carbonate, and QPAC® 40, polypropylene carbonate, are the two most widely used products within our family of binders. However, there are a wide range of QPAC® polymers possible by varying the epoxide monomer or using blends of epoxides to produce a specific reaction. Our technical group has the expertise to effectively work with you to develop the appropriate product for your application.

Advantages of QPAC®

The following is a short list identifying some of the advantages of QPAC®. However, the advantages that our customers see goes well beyond those listed below.

Benign emissions	Water and CO_2
Low temperature / clean burnout	Onset at 220°C, complete at 340°C
Virtually no residue	Less than 10 ppm residue ash and metal
All sintering atmospheres	Nitrogen, Oxygen, Argon, vacuum (oxygen generated in debind)
Controlled debind	Polymer chain unzipping means controlled migration of debind emissions through the part. Also results in excellent pore size management.
Excellent green strength	Tacky, high molecular weight, amorphous thermoplastic polymer allows high density green shapes, tapes, films and other structures

Typical Applications

QPAC® polymers can be processed using typical processing techniques, including solution processing, spin casting, injection molding or extrusion. This family of copolymers has attractive performance characteristics in a variety of applications. The following table shows some of these applications and QPAC®'s benefits:

Application	Benefits	End Use/Industry
Electronic ceramic binders	> Improve green strength and lubricity > Complete burnout at low temperature in any firing atmosphere > Low ash content	Electronic/technical ceramics, powder metals
Technical glass binders	> Compatible with a variety of sealing glasses > Complete decomposition > Low ash content	Display screens, discharge lamps, glass preforms
Brazing solutions	> Compatibility with a variety of filler metals > Viscosities are custom-tailored for solution or paste requirements	Automotive, HVAC, aircraft
Diamond cutting tools	> Coats diamond powders evenly > Decomposition is uniform and controlled reducing the likelihood of cracks and voids in the final part	Construction, cutting tools
Energenics	> Decomposition is uniform and controlled > Flame temperatures are noticeably reduced during combustion	Propellants, pyrotechnics, airbag inflators
Pore formers	> Decomposes completely by 340°C in any environment > Amorphous thermoplastic which will solubilize completely and homogeneously	Mesoporous carbon composites, titanium structures, nanomaterials
Polymer foaming aids	> Reduced density of high temperature thermoplastics > Environmentally acceptable > Low temperature decomposition	Engineering thermoplastics for numerous industries
Lost foam casting	> Complete burnout > Minimal carbon residue	Metal castings, foundries, aluminum, iron

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