Prometheus Equity Partners Pty Ltd
ACN 080 056 499

29/51 The Crescent, Manly, NSW 2095
Tel (02) 9948-8101
Email: robmuir@pepvc.com

SAMPLE ONLY
R&D BUSINESS OPPORTUNITY MARKETING COLLATERAL

ZERO SHRINK POLYMERS

BUSINESS OPPORTUNITY

Contact Information
Date

Executive Summary

PEP Ventures is seeking R&D partners to commercialize a proprietary spiro-carbonate terpolymer system which may have controlled shrinkage properties.

It is anticipated that the terpolymer may be used to produce a wide range of new engineering plastics, composites, adhesives and coatings.

This business opportunity will appeal to technology based companies who are:

- Producers of epoxy resins, thermoset engineering plastics or composites and who wish to protect or expand their current technology base, or

- Seeking to acquire or to license an advanced engineering polymer to establish or sustain a competitive business opportunity in engineering plastics, composites, adhesives, coatings etc.

Desirable characteristics in a commercial partner include:

- Current producer of engineering polymer materials,

- Corporate objectives which include growth through chemical polymer technology,

- Availability, or access to, strong R&D capability,

- Strong process design and engineering skills,

- Production and marketing capability of polymer plastics.

PEP Ventures would prefer to commercialize the ZSP technology through an R&D option agreement for specific uses under future patent and proprietary know how rights with a sponsored research agreement.

Background

Fifteen years of research in thermosetting polymers, particularly in epoxy resins, have not solved the shrinkage problems associated with curing the polymer.

The uncontrolled shrinkage of the polymers eventually leads to microcrack related failures in the final cured polymeric materials.

Bailey and associates demonstrated that spiro compounds underwent ring opening homopolymerization under the influence of a catalyst. Recently it was claimed that these compounds copolymerized with epoxies to reduce or eliminate shrinkage. In practice, however, these compounds have not met expectations.

The Technology

PEP Ventures is developing a new copolymerization process which combines a spiro-orthocarbonate, an epoxy prepolymer and a curing agent to attempt to produce an organic polymer with controlled shrinkage properties: zero shrinkage polymer (ZSP). Composition of matter, formulations and process comprise the patent claims.

ZSP polymers typically are formulated as follows:

Component A	Component B	Component C
Spiro-carbonates	Co-reactants	Modifier
Melting points within range of 50 to 300C	Epoxies Polyamides Polyimides	Crosslinkers Catalysts Promoters
Estimated Cost $4-6/lb	Commercial	Commercial

By varying the formulation, the polymers may be made to expand during cure and to increase thermal stability. Polymers can be made that are essentially crystal clear.

The Opportunity

PEP Ventures anticipates that these new zero shrinkage polymers may displace existing plastics from traditional coatings, paints and matrix applications because many current product failures have been traced to shrinkage that occurs during curing. Stresses build in composites between the fiber and matrix material during cure, paint cracks due to constriction during drying and adhesives fail as the bond weakens during curing.

The Market

While there are a number of major markets that ZSP polymers might penetrate, a conservative estimate of potential market size can be made by comparison with the market for epoxy resins. These resins generally exhibit the least shrink during cure of the most widely marketed plastics.

The January 2004 issue of Modern Plastics published patterns of use and consumption for epoxy resins for 2003 as follows:

USES OF EPOXY RESINS

Use Category	Millions of Lbs	% Total
Adhesives & Binders	19	5.3
Flooring & Paving	18	5.0
Protective Coatings	160	44.3
Electrical Laminates	44	12.2
Structural Laminates	21	5.8
Tool, Casting, Molding	26	7.2
Export	43	11.9
Other Uses	30	8.3
TOTAL	361	100.0

Various estimates of growth rate for epoxy resins have been published with typical rates of around five percent per year.

The most likely applications for PEP Venture's zero-shrink would be in adhesives, coatings, laminates, and moldings. The 2003 consumption for these four categories was 270 million pounds.

As presently formulated, PEP Venture's ZSP polymers would contain about 25 wt. % of the proprietary component to obtain zero shrinkage. Assuming a market penetration of 10% is achieved in five years, ZSP polymers could capture around (270 million) (0.25) (0.10) = 6.75 million lbs./year. At a price of $3.00/lb. for epoxy resins, the potential market value for PEP Venture's ZSP polymers would exceed $20 million/year.

Based on current information, ZSP polymers could be produced in the range of $11-13 per pound.

It is also anticipated that the ZSP polymers will capture a small fraction of the non-epoxy market particularly those for bispolyimides and bismaleimides. The 2004 figures for all reinforced plastics were estimated at over 2200 million pounds.

The Competition

Competition for PEP Ventures' ZSP polymers is expected to come from new developments within the epoxy resins themselves and from analogue materials developed by Epolin, Inc. (Bailey) and Enhanced Composites.

The primary makers of epoxy resins include all the major chemical and petrochemical companies such as Dow, Shell, and DuPont.

Since the cost of entry as a potential resin manufacturer is prohibitive and the majors are already well established, PEP Ventures does not plan to engage in a head to head competition but rather to commercialize the technology by licensing selected rights.

The Technical Status

PEP Ventures ZSP polymer technology is classfied as "Pioneer" since additional development is required for:

- Applications development to produce industrial products for fiber composites, structural adhesives, corrosion and temperature resistant coatings, precision lenses, fiber optics.
- Product development to synthesize related polymers for specific applications and complete physiochemical characterization.
- Process development of an economic manufacturing scale process.

The Development Plan

To date, several new monomers have been synthesized and several new polymer/copolymer formulations made. Results thus far have been mixed, but indicate that zero shrinkage, and possibly expansion, may be obtained by controlling the proportion of the proprietary Monomer.

Two avenues of development are necessary because it is desirable to obtain as strong a patent position as possible and to reach commercialization as rapidly as possible.

First, additional monomers in the new class discovered by PEP must be synthesized and patented. Second, polymers and copolymers must be formulated and their physical and chemical properties determined before it will be possible to determine all potential applications. This later stage must be performed in unison with an appropriate industrial partner to focus on and to address the commercial requirements of industry.

PEP has prepared the following draft development plan which consists of four phases:

- Phase 1 - Product Development
- Phase 2 - Applications Research
- Phase 3 - Market Research
- Phase 4 - Process Development

The principal activities in each phase are summarized as follows:

Phase 1 - Product Development

This phase of the program consists of a series of planned studies to develop synthetic methods for the preparation of selected monomers and polymers and to characterize the physiochemical properties of the synthesized products. These studies will include the following types of experimental activities:

Preparative Syntheses
Monomers - representative selection of structural variants.
Homopolymers - spectrum of molecular weight distributions.
Copolymers - range of comonomer types and combinations.

Physiochemical Characterization
Monomers - m.p.; b.p.; NMR, MS spectra; solubility.
Polymers - mol. wt.; IR spectrum; DSC, TMA, DMA; density.

The results of this phase will be used to evaluate the feasibility of synthetic processes and to establish structure-property relationships. In addition, technical data and samples of experimental products will be prepared for submission to selected companies for specific evaluations.

Phase 2 - Applications Research

This phase of the program consists of concerted investigations to assess the utility of the experimental controlled-shrinkage polymer systems for new and established uses including the following generic types of products:

- Fiber composites
- Structural adhesives
- High temperature coatings
- Corrosion resistant coatings
- Photo-resins
- Precision lenses
- Fiber optics
- Biomedical prostheses

Generally, the developmental studies will involve the following types of activities:

(a) identification of target products;
(b) assessment of target product technology;
(c) definition of technical requirements;
(d) identification of deficiencies in established products;
(e) preparation of suitable test specimens for the evaluation of selected mechanical, thermal, electrical and optical properties; and
(f) the formulation, fabrication and evaluation of selected prototype products.

Phase 3 - Market Research

This phase of the program involves technoeconomic studies of promising developmental products to assess their technical and market potential. Major marketing factors to be studied for each candidate product include the following segments:

Product Properties.
Physicochemical properties; specifications and impurities; containers and storage; safety considerations.

Market Characteristics.
Uses and expected volume; product cost and price range; number and character of customers; technical requirements.

Competing Products.
Physiochemical properties; market characteristics; number and character of manufacturers and suppliers.

Patents and Legal Aspects.
Relevant product and use patents; licensing practices; governmental regulations.

The specificity and detail of the technoeconomic studies will vary according to the developmental stage and the character of each candidate product application.

Phase 4 - Process Development.

This phase of the program consists of applied research and chemical engineering studies to develop the most economic, desirable, and technically feasible method for producing selected product(s). Major production factors to be investigated for each selected final product include the following major elements:

Raw Materials
Suppliers, costs, specifications and impurities, storage, safety factors, product and use requirements.

Process Characteristics.
Chemical character of processes, continuous/equilibrium steps, reaction kinetics, yields and conversions, material balances.

Production Equipment.
Process flow characteristics, standard unit operations equipment, special design and fabrication requirements.

Production Requirement.
Production facility, labor and power requirements, optimum production rate, process patents, safety factors.

The information produced from these studies will provide the physiochemical properties and the production costs of the product or family of products which can be produced by the ZSP process commercially.

Approximate Plan Costs

PEP estimates that this entire draft commercialization plan could be completed in three years with some 170 man-months of effort at a total cost of around $1.5 million. This estimate is based on current research and overhead costs and will vary significantly depending upon the interest and extent of the participation of the venture partner.

The Venture Partner

PEP Ventures is seeking the resources and capability of an established company to commercialize the novel ZSP polymer technology by developing specific industrial applications.

PEP's contributions will include the proprietary technology, technical expertise and assistance, future patents and know how, and the staff and resources of a major research facility.

The opportunity will appeal to technology based companies who are:

- Producers of epoxy resins, thermoset engineering plastics or composites and who wish to protect or expand their current technology base, or
- Seeking to acquire or to license an advanced engineering polymer to establish or sustain a competitive business opportunity in engineering plastics, composites, adhesives, coatings etc.

Desirable characteristics in a commercial partner include:

- Current producer and/or user of engineering polymer materials,
- Corporate objectives which include long term commitment, allocation of resources and growth through chemical polymer technology,
- Availability, or access to, strong scientific skills in R&D to:
  - specify particular plastic and composite industrial applications.
  - measure and characterize mechanical and chemical properties of coatings, adhesives and composite materials,
  - formulate and test composites for industrial applications including life cycle, temperature stability, creep, residual stress and strength tests,
- Strong process design and engineering skills to support R&D efforts.
- Production and marketing capability of polymer plastics.

The Proposed Arrangement

PEP Ventures would prefer to commercialize the ZSP technology through an R&D option agreement for specific uses under future patent and proprietary know how rights with a sponsored research agreement. Various options would be built in to match the various stages of research.

For additional information, PLEASE CONTACT: