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PREVIEW

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resin systems**

Bennett, Gregory Scott, Ph.D.

University of Massachusetts, 1992

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300 N. Zeeb Rd.
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PREVIEW

**THE STUDY OF REACTIVE THERMOPLASTIC OLIGOMER
MODIFIED EPOXY-AMINE RESIN SYSTEMS**

A Dissertation Presented

by

GREGGORY S. BENNETT

**Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of**

DOCTOR OF PHILOSOPHY

February 1992

Polymer Science and Engineering

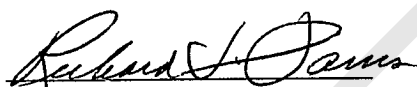
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PREVIEW

THE STUDY OF REACTIVE THERMOPLASTIC OLIGOMER
MODIFIED EPOXY-AMINE RESIN SYSTEMS


A Dissertation Presented
by
GREGGORY S. BENNETT

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To my Dad and Mom. Thank You!

PREVIEW

"All I want to know are God's thoughts...the rest are details."

-Albert Einstien, Scientist.

"Happy are those whose hearts are pure, for they shall see God."

-Jesus of Nazareth, Son of God.

PREVIEW

ACKNOWLEDGEMENTS

The four years that I have spent at the University of Massachusetts have probably been the most formative four years of my life. And while it is an honor and a privilege to receive a doctoral degree it is the people who have been here and who will be elsewhere that make times memorable. I'm not sure if this happens to everyone but I have mentally written parts this section of my dissertation several times. Because I think people will read this section more than any of the others I hope to adequately relate my deep appreciation to those who have given me so much!

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Finally, I think it is obvious that God has blessed me very greatly with the friends, and family I've been surrounded with and the talents I've been given. I thank Him for all He has done.

ABSTRACT

THE STUDY OR REACTIVE THERMOPLASTIC OLIGOMER MODIFIED EPOXY-AMINE RESIN SYSTEMS

FEBRUARY 1992

**GREGGORY S. BENNETT, B.S., UNIVERSITY OF WISCONSIN
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Directed by: Professor Richard J. Farris

A series of reactive poly(aryl ether ketone) oligomers of controlled molecular weight, based on substituted hydroquinones and 4,4'-difluorobenzophenone, have been synthesized and incorporated into commercial high performance epoxy-amine resin systems. The thermal and spectroscopic characteristics of the oligomers as a function of chemical structure and molecular weight have been evaluated. The oligomers are initially miscible in the epoxy-amine mixtures but are observed to phase separate during the curing process. Two phases, a thermoplastic-rich phase and a thermoset-rich phase have been identified. Four distinct morphologies; a thermoset-rich continuous phase with thermoplastic-rich inclusions, a thermoplastic-rich and thermoset-rich mixed continuous phase, a thermoplastic-rich continuous phase with thermoset-rich inclusions, and a single phase system have been observed.

The morphology/property/processing relationship has been studied as a function of oligomer loading level, oligomer chemical structure, oligomer

molecular weight, and curing temperature. The final thermal and mechanical properties were shown to be dependant on the phase separated morphology. Resins with thermoplastic-like toughness and thermoset-like processing characteristics have been attained when a thermoplastic-rich continuous phase is achieved. Composite and adhesive characteristics have also been measured.

The synthesis and characterization of novel thermotropic liquid crystalline poly(aryl ether ketone)s is also presented. A series of copolymers based on a 4,4'-biphenol mesogen and a crystal disrupting substituted hydroquinone have been synthesized. Copolymers containing between 50% and 75% biphenol were found to possess liquid crystalline characteristics. These materials are believed to be the first thermotropic liquid crystalline poly(aryl ether ketone)s reported to date.

TABLE OF CONTENTS

ACKNOWLEDGEMENT.....	<u>Page</u> vi
ABSTRACT	ix
LIST OF TABLES.....	xxi
LIST OF FIGURES.....	xxiv
 Chapter	
I. HIGH PERFORMANCE POLYMERS	1
Introduction.....	1
Thermosets.....	2
Thermoplastics	6
Thermoplastic/Thermoset Hybrid Materials	10
Dissertation Objective and Overview.....	17
 II. REACTIVE POLY(ARYL ETHER KETONE) THERMOPLASTIC OLIGOMER SYNTHESIS AND CHARACTERIZATION.....	 20
Introduction.....	20
Background	20
Reactive Poly(aryl ether ketone) Oligomer Synthesis	24
One-Step Reactive Poly(aryl ether ketone) Oligomer Synthesis	31
Experimental.....	31
Materials and Methods.....	31
One-Step Reactive Oligomer Synthesis	33
One-Step Reactive Oligomer Synthesis Results and Discussion.....	35
One-Step Reactive Oligomer Synthesis Conclusions.....	37
Two-Step Reactive Poly(aryl ether ketone) Oligomer Synthesis	38
Experimental.....	38

Materials and Methods.....	38
Two-Step Reactive Oligomer Synthesis.....	39
Two-Step Reactive Oligomer Synthesis Results and Discussion.....	42
Two-Step Reactive Oligomer Synthesis Conclusions.....	44
Reactive Poly(aryl ether ketone) Oligomer Characterization.....	44
Experimental	45
Reactive Oligomer Spectroscopic Analysis.....	46
NMR and FTIR	46
t-Butylhydroquinone-Based Poly(aryl ether ketone)..	46
Methylhydroquinone-Based Poly(aryl ether ketone) .	55
Phenylhydroquinone-Based Poly(aryl ether ketone)..	62
WAXS	70
Reactive Oligomer Thermal Analysis	74
DSC	74
TGA.....	79
Reactive Oligomer Physical Characteristics.....	80
Density	80
Uniaxial Tensile Properties.....	81
Chapter Conclusions.....	86
III. REACTIVE POLY(ARYL ETHER KETONE) THERMOPLASTIC OLIGOMER MODIFICATION OF HIGH PERFORMANCE EPOXY/AMINE RESINS	89
Introduction.....	89
Background	90
Experimental.....	91
Materials.....	91
Reactive Thermoplastic Oligomer Synthesis	93
Reactive Thermoplastic Oligomer/Thermoset Resin Formulation	93
Mechanical Properties.....	94

Mechanical Property Sample Preparation.....	94
Flexural Modulus Determination.....	95
Critical Stress Intensity Factor and Fracture Energy Determination.....	96
Thermal Properties.....	99
Differential Scanning Calorimetry	99
Dynamic Mechanical Measurements	99
Morphological Properties	99
Transmission Electron Microscopy.....	99
Scanning Electron Microscopy	100
Low Molecular Weight-Based Reactive Thermoplastic Oligomer Modified Epoxy-Amine Resin Systems.....	100
Introduction	100
t-Butylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	101
Results.....	101
Resin Formulation	101
3100 Mn tBPK/E828-DDS Resin Mechanical Properties	101
3100 Mn tBPK/E828-DDS Resin Morphological Properties	105
Transmission Electron Microscopy	105
Scanning Electron Microscopy.....	111
3100 Mn tBPK/E828-DDS Resin Thermal Properties	111
Differential Scanning Calorimetry.....	111
Dynamic Mechanical Measurements.....	116
3100 Mn tBPK/E828-DDS Resin Processing Properties	116
3100 Mn tBPK/E828-DDS Resin Property Summary.....	123

3100 Mn tBPK/E828-DDS Resin Discussion	124
3100 Mn tBPK/E828-DDS Resin Conclusions.....	142
Methylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	144
Results.....	144
Resin Formulation	144
3100 Mn MePK/E828-DDS Resin Mechanical Properties	145
3100 Mn MePK/E828-DDS Resin Morphological Properties	145
3100 Mn MePK/E828-DDS Resin Thermal Properties	150
Differential Scanning Calorimetry.....	150
Dynamic Mechanical Measurements.....	150
3100 Mn MePK/E828-DDS Resin Processing Properties	153
3100 Mn MePK/E828-DDS Resin Property Summary.....	153
3100 Mn MePK/E828-DDS Resin Discussion	154
3100 Mn MePK/E828-DDS Resin Conclusions.....	162
Phenylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	164
Results.....	164
Resin Formulation	164
2600 Mn PhPK/E828-DDS Resin Mechanical Properties	164
2600 Mn PhPK/E828-DDS Resin Morphological Properties	165
2600 Mn PhPK/E828-DDS Resin Thermal Properties	165
Differential Scanning Calorimetry.....	165
Dynamic Mechanical Measurements.....	168
2600 Mn PhPK/E828-DDS Resin Processing Properties	168

2600 Mn PhPK/E828-DDS Resin Property Summary.....	169
2600 Mn PhPK/E828-DDS Resin Discussion.....	169
2600 Mn PhPK/E828-DDS Resin Conclusions.....	173
Low Molecular Weight-Based Reactive Thermoplastic Oligomer Modified Epoxy-Amine Resin Conclusions	174
Intermediate Molecular Weight-Based Reactive Thermoplastic Oligomer Modified Epoxy-Amine Resin Systems.....	175
Introduction	175
t-Butylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	175
Results.....	175
Resin Formulation	175
9000 Mn tBPK/E828-DDS Resin Mechanical Properties	176
9000 Mn tBPK/E828-DDS Resin Morphological Properties	178
Transmission Electron Microscopy	178
Scanning Electron Microscopy.....	182
9000 Mn tBPK/E828-DDS Resin Thermal Properties	190
Differential Scanning Calorimetry.....	190
Dynamic Mechanical Measurements.....	190
9000 Mn tBPK/E828-DDS Resin Processing Properties	190
9000 Mn tBPK/E828-DDS Resin Discussion	191
9000 Mn tBPK/E828-DDS Resin Conclusions.....	198
Methylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	199
Intermediate Molecular Weight MePK Discussion	199
Intermediate Molecular Weight MePK Conclusions.....	200

Phenylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	200
Results.....	200
Resin Formulation	200
5500 Mn PhPK/E828-DDS Resin Mechanical Properties	201
5500 Mn PhPK/E828-DDS Resin Morphological Properties	202
5500 Mn PhPK/E828-DDS Resin Thermal Properties	202
Differential Scanning Calorimetry.....	202
Dynamic Mechanical Measurements.....	202
5500 Mn PhPK/E828-DDS Resin Processing Properties	203
5500 Mn PhPK/E828-DDS Resin Discussion.....	203
5500 Mn PhPK/E828-DDS Resin Conclusions	206
Intermediate Molecular Weight-Based Reactive Thermoplastic Oligomer Modification Epoxy-Amine Resin Conclusions	207
High Molecular Weight-Based Reactive Thermoplastic Oligomer Modified Epoxy-Amine Resin Systems.....	208
Introduction	208
t-Butylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	209
Results.....	209
Resin Formulation	209
15,000 Mn tBPK/E828-DDS Resin Mechanical Properties	209
15,000 Mn tBPK/E828-DDS Resin Morphological Properties	210
15,000 Mn tBPK/E828-DDS Resin Thermal Properties	213
Differential Scanning Calorimetry.....	213
Dynamic Mechanical Measurements.....	213

15,000 Mn tBPK/E828-DDS Resin Processing Properties	213
15,000 Mn tBPK/E828-DDS Resin Discussion	214
15,000 Mn tBPK/E828-DDS Resin Conclusions.....	216
Methylhydroquinone Poly(aryl ether ketone)/ Epoxy-Amine Resin Systems.....	217
High Molecular Weight MePK Discussion.....	217
High Molecular Weight MePK Conclusions	217
High Molecular Weight-Based Reactive Thermoplastic Oligomer Modified Epoxy-Amine Resin Conclusions	218
Chapter Conclusions.....	218
IV. PHASE SEPARATION, GELATION, AND VITRIFICATION CHARACTERISTICS OF REACTIVE POLY(ARYL ETHER KETONE) THERMOPLASTIC OLIGOMER MODIFIED EPOXY/AMINE RESINS.....	220
Introduction.....	220
Background	220
Experimental.....	223
Materials.....	223
Methods.....	223
Results.....	227
Discussion	238
Chapter Conclusions.....	250
V. COMPOSITE AND ADHESIVE PROPERTIES OF REACTIVE POLY(ARYL ETHER KETONE) THERMOPLASTIC OLIGOMER MODIFIED EPOXY/ AMINE RESINS.....	251
Introduction.....	251
Background	252
The Effect of Volumetric Constraint	253
Volumetric Constraint Introduction.....	253
Volumetric Constraint Experimental.....	254

Volumetric Constraint Materials	254
Volumetric Constraint Methods.....	256
Volumetric Constraint Results.....	258
Volumetric Constraint Discussion.....	264
Volumetric Constraint Conclusions	269
The Effect of Carbon Fiber Incorporation.....	270
Carbon Fiber Incorporation Introduction.....	270
Carbon Fiber Incorporation Experimental.....	271
Carbon Fiber Incorporation Materials.....	271
Carbon Fiber Incorporation Resin Formulation	271
Carbon Fiber Incorporation Transmission Electron Microscopy	272
Carbon Fiber Incorporation Results.....	272
Carbon Fiber Incorporation Discussion	275
Carbon Fiber Incorporation Conclusions.....	278
Lap Shear Adhesion Characteristics	278
Lap Shear Adhesion Introduction	278
Lap Shear Adhesion Experimental	279
Lap Shear Adhesion Materials.....	279
Lap Shear Adhesion Equipment.....	279
Lap Shear Adhesion Sample Preparation	280
Lap Shear Adhesion Results	280
Lap Shear Adhesion Discussion	281
Lap Shear Adhesion Conclusions.....	283
Thermal Expansion Coefficient Determination	283
Thermal Expansion Coefficient Introduction.....	283
Thermal Expansion Coefficient Experimental.....	284
Thermal Expansion Coefficient Materials.....	284
Thermal Expansion Coefficient Equipment.....	284
Thermal Expansion Coefficient Results.....	284
Thermal Expansion Coefficient Discussion	288
Thermal Expansion Coefficient Conclusions.....	289

Chapter Conclusions.....	289
VI. NOVEL THERMOTROPIC LIQUID CRYSTALLINE POLY(ARYL ETHER KETONE)S	292
Introduction.....	292
Background	292
Experimental.....	295
Materials.....	295
Methods.....	296
Synthesis	296
Results.....	301
Biphenol/t-Butylhydroquinone-based Copolymer Results.....	301
90% Biphenol/10% t-Butylhydroquinone Copolymer Results.....	301
75% Biphenol/25% t-Butylhydroquinone Copolymer Results.....	304
50% Biphenol/50% t-Butylhydroquinone Copolymer Results.....	308
25% Biphenol/75% t-Butylhydroquinone Copolymer Results.....	315
Biphenol/Phenylhydroquinone-based Copolymer Results.....	317
75% Biphenol/25% Phenylhydroquinone Copolymer Results.....	317
50% Biphenol/50% Phenylhydroquinone Copolymer Results.....	319
50BI/50PH-A Results	320
50BI/50PH-B Results.....	335
25% Biphenol/75% Phenylhydroquinone Copolymer Results.....	335
Weight Loss Properties Results.....	339
Mechanical Properties Results	340
Discussion.....	345
Biphenol/t-Butylhydroquinone-based Copolymer Discussion.	345

90% Biphenol/10% t-Butylhydroquinone Copolymer	
Discussion	345
75% Biphenol/25% t-Butylhydroquinone Copolymer	
Discussion	346
50% Biphenol/50% t-Butylhydroquinone Copolymer	
Discussion	347
25% Biphenol/75% t-Butylhydroquinone Copolymer	
Discussion	349
Biphenol/Phenylhydroquinone-based Copolymer Discussion.	349
75% Biphenol/25% Phenylhydroquinone Copolymer	
Discussion	349
50% Biphenol/50% Phenylhydroquinone Copolymer	
Discussion	351
50BI/50PH-A Discussion.....	351
50BI/50PH-B Discussion.....	354
25% Biphenol/75% Phenylhydroquinone	
Discussion	356
Weight Loss Properties Discussion	356
Mechanical Properties Discussion	357
Potential Applications Discussion	358
Potential Applications: High Performance	
Thermoplastics.....	359
Potential Applications: Processing Aids.....	360
Potential Applications: Reinforcing Agents	360
Potential Applications: Fibers and Films.....	361
Potential Applications: Melt Polymerizable Materials...	362
Chapter Conclusions.....	363
VII. CONCLUSIONS AND FUTURE WORK	365
Introduction	365
Dissertation Conclusions.....	365
Future Work	370
Future Work Conclusions	374
REFERENCES	375
BIBLIOGRAPHY.....	390