

# MidAtlantic Rubber & Plastic Group

## Fall 2009 Newsletter



MidAtlantic Rubber & Plastics Group

[www.marubber.org](http://www.marubber.org)

### CHAIR'S MESSAGE



In the last Chair's message, I had commented about the recent lay-offs in the local rubber and plastic industries and we had low attendance at most rubber groups' technical meetings. I expressed the hope that the next Chair's Message in the newsletter would be all positive. Well, I believe it is all positive.

This year is the Centennial of the Rubber Division of the American Chemical Society. A black-tie Celebration was held on May 4<sup>th</sup> in the Akron area to celebrate this event. Several of the MAR&PG Board Members attended. This group can clean up nicely!

The celebration will continue at the Rubber Expo to be held in Pittsburgh from October 13 to 15<sup>th</sup>. Good news is that the host Hotel (Weston) is already sold out so get your reservation in soon. Preregistration has been extended until October 5<sup>th</sup>.

We had a very enjoyable golf outing this year at the Yardley Country Club on August 4<sup>th</sup>. A great course, great weather and a good time was had by all.

We just completed an outstanding Fall Technical meeting held in King of Prussia on Sept 24 at the Clarion Park Ridge Hotel. Attendance was up significantly compared to the technical

meeting held at the Architect's Club near Phillipsburg, NJ. Holding the technical meeting either near Philadelphia or near New York appears better than mid-way between the two locations. Four great papers were presented on timely topics.

We also had "past Chairs night" on September 24 and acknowledged two past Chairs from MAR&PG, five past chairs for the Philadelphia Rubber Group and four chairs for the New York Rubber Group. Their continued effort and support for the new MAR&PG is appreciated. Our membership in the MAR&PG is up significantly from last year. I am most pleased that the number of new members has doubled since last year.

Great things yet to come:

- New Web page for MARubber.org will be launched soon thanks to the efforts of Brett Robb of Sartomer. This will include all events, directions to all events, ability to pay annual dues and meeting registration on line, plus newsletters and scholarship applications and past scholarship winners.
- Introduction class on Rubber Technology and plant tour is planned next fall.
- A one-day Rubber & Plastic Professional training class is planned for next summer
- Watch for the scholarship application on our web page. We are increasing funds.
- Nominations for Officers and Board of Director. Please submit names soon.

Remember the politically updated quote from Theodore Roosevelt:

Every man (and woman) owes some of his (or her) time to the up-building of the profession to which he (or she) belongs.

Volunteer now. We need your support to make this organization even better.

Ron Campbell  
2009 MARPG Chair



## ACS/Rubber Division Meeting in Pittsburgh Oct. 12-15, 2009

The Student Job Fair will be held Thursday 10/15/09 at 8:00 – 10:00 a.m. in the technical symposia area. This is your company's opportunity to hire these talented students before someone else does. Contact Missy Beynon at [mbeynon@rubber.org](mailto:mbeynon@rubber.org) if your company would like to have a table at the Job Fair to meet the students.

The Student Colloquium and Poster Session will be held Wednesday 10/14/09 at 8:00 a.m. – 5:00 p.m. in the technical symposia area. Come out and support the talented students who may be your future employees.

The 25-Year Club Luncheon will be held Wednesday at 11:30 a.m. - 1:00 p.m. Reservations are required.

Note: The 5K Run/Walk will be held Wednesday and you need to meet at 6:30 a.m. in the Lobby of the Westin Convention Center Pittsburgh Hotel (host hotel).

The Area Director and Alternate Area Director will be attending all necessary governance meetings to represent the MARPG.

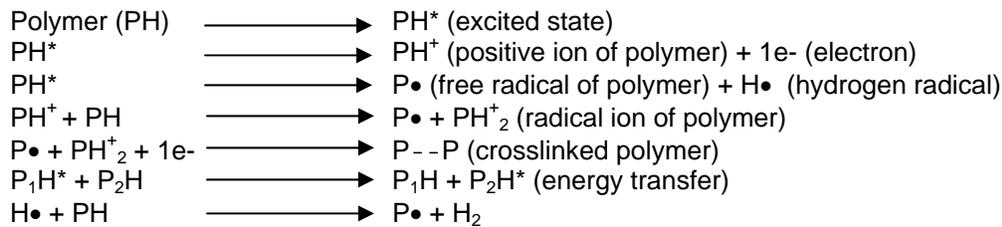
Robert Carroll, Area Director

### TECHNICAL PAPERS

## Comparing Electron Beam Irradiation and Peroxide Cure

Radiation curing has historically been used as an alternative to peroxides in applications where the curatives themselves or side-products of vulcanization are viewed as impurities in the final product. Peroxide cure progresses through a series of radical intermediates, each of which can undergo side reactions which may not necessarily contribute to crosslink density. Radiation cure, on the other hand, has been promoted as a cleaner and more homogeneous cure process. Electron beam irradiation has been used in the rubber and plastics industries for longer than 30 years and has been applied to a wide range of commodity and specialty polymers.

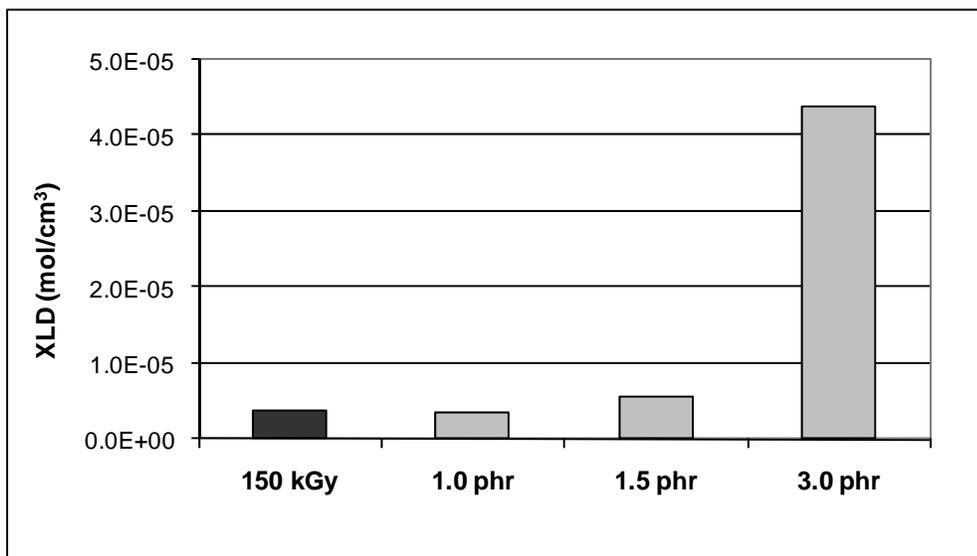
Vulcanization by electron beam irradiation involves the interaction of high energy electrons and an elastomer. Ionizing radiation produces an excitation of polymer molecules in the vicinity of the impinging radiation. The energies associated with the excitation are dependent on the irradiation dosage and voltage (velocity) of electrons. The interaction results in formation of free radicals formed by dissociation of molecules in the excited state or by interaction of molecular ions. The free radicals or molecular ions can react by connecting the polymer chains directly or initiating grafting reactions. The mechanism of electron beam cure is summarized in Figure 1.



**Figure 1. Proposed mechanism for electron beam curing.**

High energy ionizing radiation produces excited polymer molecules as well as abundant secondary electrons which are capable of interacting with other molecules including coagents.

While both peroxide and electron beam cure involve radical-based intermediates, differences between the mechanisms do exist. While peroxide cure is a thermally initiated event with cure temperatures routinely in the 160°C to 180°C range, electron beam cure is performed at room temperature. Peroxide cure is initiated by oxygen-centered radicals that can be differentiated from the carbon-centered radicals produced by polymer excitation in radiation cure. The length of cure time in each system is also very different. In peroxide cure, cure time is governed by the half life of the peroxide at a given temperature, and can be longer than 30 minutes to reach > 99% decomposition. In contrast, electron beam cure is practically instantaneous. The cure temperature and cure time differences can result in significantly less energy applied to the electron beam cure process, a fact which may contribute to variations in coagent performance between the disparate systems. Figure 1 demonstrates the relative efficiency of the two curing systems. It is shown that for a model EPDM formulation (Appendix), 150 kGy of incident radiation provides similar crosslink density (XLD) to 1.0 phr dicumyl peroxide loading.



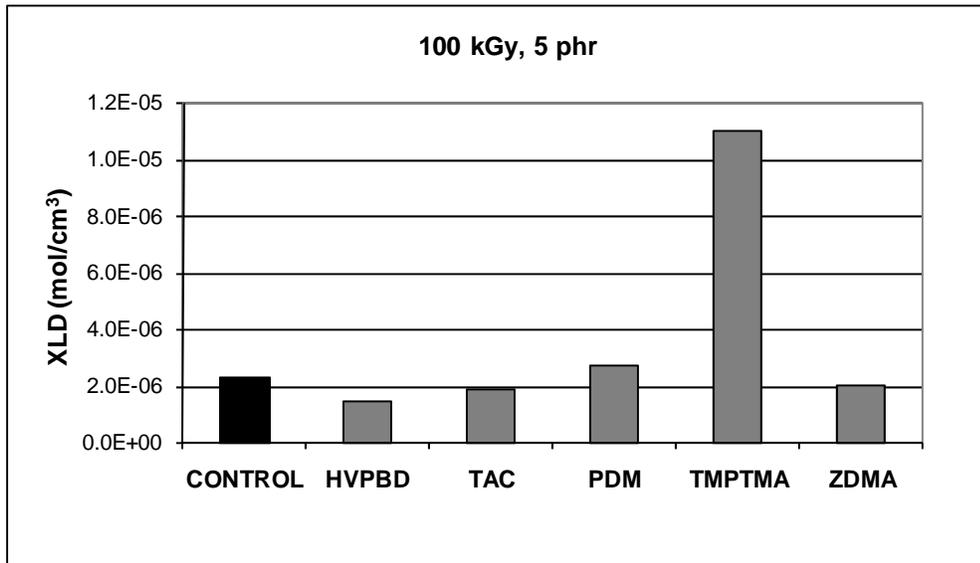
**Figure 1. Crosslink density (XLD) as a function of dicumyl peroxide loading (phr) compared to 150 kGy electron beam radiation.**

Coagents are multifunctional monomers and resins that can participate in a number of radical reaction mechanisms, the most beneficial including grafting and radical addition. There are many different coagent products available (Table 1), each following specific structure-property relationships. Crosslink density is found to be not only a function of radiation dose (parallel to peroxide loading) but also coagent loading.

Code	Description
TMPTMA	Trimethylolpropane trimethacrylate
HVPBD	High vinyl polybutadiene
TAC	Triallyl cyanurate
PDM	N,N' - <i>m</i> - Phenylenedimaleimide
ZDMA	Zinc dimethacrylate

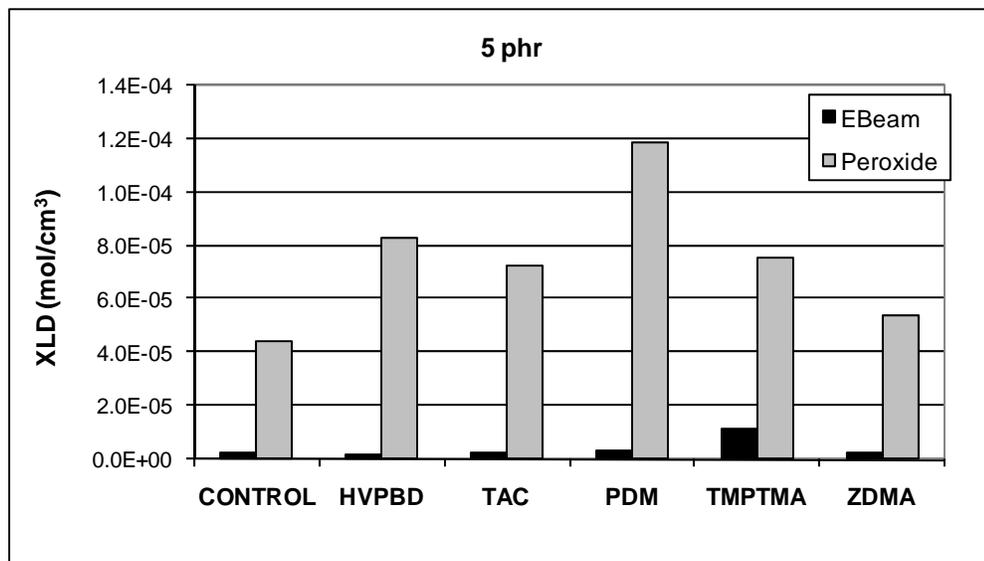
**Table 1. Commercially available coagents.**

Figure 2 provides a comparison of coagents in the same model EPDM formulation (5 phr coagent loading). It can be seen that, as a class, methacrylate ester monomers are clearly the most effective at building crosslink density.



**Figure 2. Crosslink density as a function of coagent type. Coagents loaded at 5 phr.**

To further demonstrate the differences between the two curing systems, the same series of coagent products was compared (3.0 phr dicumyl peroxide vs. 150 kGy radiation). Figure 3 shows the results of the same study in the model EPDM formulation, with the peroxide crosslink density overlaid. Note that while the peroxide loading produced higher overall crosslink density, the relative trend in coagent performance is also very different. While all coagent grades provide some level of benefit over the control in peroxide cure, only the methacrylate improves the properties of the radiation-cured system.



**Figure 3. Crosslink density as a function of cure system (e-beam vs. peroxide) and coagent type (5 phr loading).**

In conclusion, peroxide cure can produce much higher crosslink density than electron-beam radiation. However, thermally induced cure systems utilize significantly higher overall energy to produce these results. It has been shown that the use of multifunctional methacrylate ester coagents can greatly increase the crosslink density of the radiation cured system.

**APPENDIX. Model EPDM formulation.**

Ingredient	phr
Nordel™ IP 4640 EPDM	100
Carbon Black (N 660)	50
Sunpar 2280®	25
Antioxidant	1
Coagent	0, 5
Peroxide	0, 1, 3

The antioxidant 2,2,4-trimethyl-1,2-hydroquinoline (Naugard Q) from Crompton Co., dicumyl peroxide (Dicup 40KE, 40% actives) from Geo Specialty Chemical, and coagent materials from Sartomer company, Inc. were used as received.

Submitted by:  
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**Solicitations Committee Report**

The MidAtlantic Rubber & Plastics Group supports our youth through the academic scholarship fund. This scholarship, that was established over 30 years ago, is funded solely by the generosity of Corporate Contributors who contribute \$250.00 or more.

This year we acknowledged our 2008 Corporate Contributors with plaques and date plates at the annual golf outing.

**Corporate Contributors**

- Burgess Pigment Co.**
- Carlisle SynTec Corp.**
- Carlisle Tire & Wheel**
- Geo Specialty**
- HM Royal**
- Holly Lubricants & Specialty Products**
- Pelmor Labs**
- R.E. Carroll Inc**
- Sartomer**
- Solvay Solexis**

**Other Contributors: R.T Vanderbilt**

Once again we thank these companies for their generosity.

The MidAtlantic Rubber Group will be soliciting for our 2009 scholarship fund in the coming months and we look forward to your continued support for this very honorable scholarship.

Joe Martin

## Scholarship Report

Look for the scholarship applications for 2010 that will be mailed out to the membership shortly

**Robert E. Carroll III**  
**Scholarship Committee**

## Membership Report

We are accepting MARPG membership renewal applications for 2009.

The renewal process only takes you a few minutes. Please fill out the attached MARPG membership form (.pdf format). This form can be also downloaded from our website ([www.marubber.org](http://www.marubber.org)) under "Join Now". Your form together with fee payment can be mailed at the address on the form or faxed at (215) 256-0925 back to me.

- Individual Members (returning) = 95
- New Members = 30
- Corporate Members = 45
- Emeritus Members = 79

Individual membership fee is \$20. Your payments in the form of a check or credit cards (Visa, Master Card, Discover and American Express) are acceptable. This year we also continue to offer a corporate membership at a rate of \$150 for 10 members per year. Please have each member fill out a separate membership form.

An alternative option is to renew or join MARPG by selecting "MidAtlantic" as your local group when you renew or join your ACS Rubber Division membership through online ([www.rubber.org](http://www.rubber.org)) or mail/ facsimile. The membership form of Rubber Division is also attached. Please return this form with payment to Rubber Division directly.

**Marty Sheridan, Membership Chair**

## MARPG Golf Outing

The MARPG held its 2009 Golf Outing was held on Tuesday August 4<sup>th</sup> at the Yardley Country Club, Yardley, PA. The event was successful with close to 50 golfers.

Here is a list of those who won the various Golfing prizes at the outing:

First Gross Score	Michael Morton
Second Gross Score	Chris Weber
Third Gross Score	Jeremy Austin
First Net Score	Jay Crowe
Second Net Score	Tom McCoy
Third Net Score	Todd Speece
Women's Long Drive #3	Lillianne Falco
Women's Long Drive #9	Lillianne Falco
Men's Long Drive #3	Mike Heishman
Men's Long Drive #13	Mike Scanish
Closest to Pin #3	Patrick Catalone
Closest to Pin #15	Ed Shimkus
Closest to Pin #17	Bill Cook



Michael Morton – Low Gross Winner

**Wally Mack**  
**Robert E. Carroll**  
**Golf Committee**

## ***Nominations Committee***

Nominations for positions on the MidAtlantic Rubber & Plastics Group Board for 2010 will be e-mailed to the membership shortly.

Here is the 2010 slate that will be sent out by the nominating Committee

<b>Chair</b>	<b>Bob Ohm</b>	<b>Lion Copolymer, LLC</b>
<b>Vice Chair</b>	<b>Steve Henning</b>	<b>Sartomer Co</b>
<b>Treasurer</b>	<b>Dick Grossman</b>	<b>Dick Grossman Consulting</b>
<b>Secretary</b>	<b>Joe Martin</b>	<b>Solvay Solexis</b>

### **Board of Directors**

<b>Kevin Schaffert</b>	<b>The Dow Chemical Co</b>	<b>(3 year term)</b>
<b>Marty Sheridan</b>	<b>R.T Vanderbilt</b>	<b>(3 year term)</b>
<b>Todd Speece</b>	<b>Sartomer Co</b>	<b>(3 year term)</b>
<b>Tim Trial</b>	<b>Ecore International</b>	<b>(2 year term)</b>

**Respectfully**  
**Tim Trial**  
**Past Chair**

