Society of Plastics Engineers • Upper Midwest Section

April 2017 • *Volume 42*

THE SPECIALIST

SPRING MINITEC

Thursday April 27, 2017

Registration: 12:30 pm - 1:00 pm • Seminar: 1:00 pm - 5:00 pm

Hennepin Technical College - Main Auditorium

9000 Brooklyn Blvd, Brooklyn Park, MN 55445

PLASTICS FAILURE: HOW AND WHY

This seminar will cover a range of topics important in understanding and diagnosing plastic component failure. The most efficient and effective approach to plastic component failure is by performing a systematic failure analysis. Someone once said, "if you don't know how something broke, you can't fix it", and this certainly highlights the importance of a thorough understanding of how and why a product has failed. This presentation will introduce the attendees to information they need to gain this understanding. The material covered will include:

- Essential knowledge of why plastic components fail
- The five factors affecting plastic part performance
- The major plastic failure mechanisms
- The process of conducting a failure investigation and methods for understanding how and why a product has failed
- Failure analysis case studies

The seminar will focus on practical problem-solving techniques and will utilize case studies to illustrate key aspects of plastic failure and prevention. Participants will gain a better understanding why plastic components fail, and how to avoid future failures by applying the knowledge learned.

Minitec ***continued on page 2***

Dan Ralph and Eric Hall Honored at the Eighth Annual Awards Gala of the Upper Midwest SPE

By Ajay Padsalgikar

Dan Ralph and Eric Hall were both honored at the Eighth Annual Awards Gala, sponsored by the Upper Midwest Section of the SPE on Saturday February 25, 2017 at the Chanhassen Dinner Theatres in Chanhassen, MN.

Dr. Shilpa Manjure, president of the Upper Midwest SPE, inducted Mr. Ralph into the Upper Midwest SPE Hall of Fame for his distinguished career as an award winning educator in Plastics Technology and Manufacturing. In addition, President Manjure conferred the President's Award on Eric Hall.

During the ceremony, Dick Bopp, Awards Chair, remarked on Mr. Ralph's many honors and achievements. Mr. Ralph is the Program Manager and Lead Instructor of the Hennepin Technical College (HTC) Plastics Manufacturing Technology Program. For more than 31 years, Mr. Ralph has been instructor for the program with literally hundreds of graduates in the Upper Midwest Region. He also provides active technical support to numerous companies needing assistance in polymer processing and plastics characterization, including 3M, Andersen Corp., Aspen Research, Cargill, NatureWorks, NTIC, Plastech, Boston Scientific, and many more. Mr. Ralph began as a Student Member of SPE in 1976, and has held continuous full membership since 1986. He provides special support to the Upper Midwest SPE Section by hosting numerous Mini & MegaTech Seminars, Board Meetings, and Tours at HTC. He was the 2010 winner of the Upper Midwest SPE "Distinguished Contributor" Award.

Annual Awards ***continued on page 2***

Minitec *continued from cover*

About the Speaker

Jeffrey A. Jansen is Senior Managing Engineer and a Partner at The Madison Group, an independent plastics engineering and consulting firm. Jeff specializes in failure analysis, material identification and selection, as well as compatibility, aging, and lifetime prediction studies for thermoplastic materials. He has been solving polymer related problems for 23 years. In that time, he has performed over 1470 failure investigations, both for industrial clients and as a part of litigation. Jeff is a regular presenter on the SPE webinar series, covering a wide range of topics related to plastics failure, material performance, testing, and polymer technology. Jeff is a graduate of Carroll College and the Milwaukee School of Engineering.

JOIN US FOR HAPPY HOUR IMMEDIATELY FOLLOWING MINITEC!

Mad Jack's, 8078 Brooklyn Blvd, Brooklyn Park, MN

REGISTER TODAY AT: www.uppermidwestspe.org

Advanced Registration (Thru April 21, 5:00 pm)		Late Registration: April 22 – April 27 / At the door	
Member:	$25	Member:	$35
Non-Member:	$50	Non-Member:	$60
Students:	No Charge	Students:	$5

Questions / Problems? Please contact Sean Mertes; sdmertes@ptsllc.com / 612-750-5159

Annual Awards *continued from cover*

After the award presentation, Dan made some brief remarks describing the beginnings of his career at HTC, graciously acknowledging the contributions of his family, students, colleagues, and mentors to his accomplishments. Many were on hand to offer their support and best wishes.

President Manjure also conferred The President's Award to Eric Hall, Advertising and Social Media Chair, for his outstanding work in overseeing the Advertising Section, managing all advertisements and sponsors for our many events and newsletters. Eric has streamlined the entire advertising process of which we all can be very proud. In recognition of this achievement, his name is added to a special plaque, arranged by Tom McNamara, listing the names of all President's Award winners. It will be displayed at the upcoming Minitec and future Section events.

The award ceremony was followed by a reception and dinner at the Chanhassen Dinner Theatres. After dinner the honorees and guests enjoyed a hilarious comedy show, 'Stevie Ray's Comedy Cabaret'.

In closing, I would like to thank the award recipients and all attendees in support of Dan Ralph and Eric Hall's outstanding contributions to SPE and our industry. Thank you, all.

Dan Ralph

Eric Hall

President's Remarks *Shilpa Manjure*

Greetings to all members in 2017!

This is our first SPEcialist communication for the year and my last one as President of the section. It has been my sincere pleasure to work for the past 3 years, with a Board that is very passionate about giving back to the plastics industry and I would like to thank each current and past member that I have had a chance to work with. In May 2017, after the ANTEC conference, a new committee elected in April will be taking on the reigns of the section.

During the past 3 years, we have been able to consistently offer seminars, plant tours, golf outings to you. Participation from you in these programs has helped support our scholarships to the students in the section and honor distinguished contributors to our industry with the Hall of Fame Award. So THANK YOU! The new committee will continue the efforts to bring cutting edge technology and speakers to your area.

We do need MORE support and volunteers on the board to make this program better. If you are an individual interested in networking and are able to volunteer a few hours every month, do reach out to any of us on the board.

2017 started off with our Eighth Annual Awards Gala which was a grand evening at the Chanhassen Dinner Theater, very meticulously organized by Richard Bopp and Ajay Padsalgikar. The red carpet was rolled out for our Hall of Fame inductee Dan Ralph and President's Award this year was given to Eric Hall, Advertisement Chair. Dan has been the Program Manager and Lead Instructor for the Plastics Engineering Technology Program at Hennepin Technical College (HTC) for the past 30+ years with more than 3000 students graduated in his program. The event was attended by dignitaries from HTC, his past students - successfully employed in the local plastics industry and industry partners who have worked with him. The one thing that was hard to miss in any testimonial was passion, dedication and enthusiasm with which he does his job. We are honored to have Dan Ralph in our Hall of Fame. Our other special guest for the evening was Eric Hall. Eric joined the board a little over a year ago. He has been a go getter. He not only understood the process, found drawbacks, fixed them and improved it all in a short period. Congratulations Eric for an award well deserved!! Please enjoy some of the clicks from the event included in the Newsletter.

Our first Minitech Seminar for the year that Sean Mertes is bringing to us is "Plastics Parts and Failure" by Jeff Jansen. Jeff has been known in the industry and SPE for his knowledge in plastics failure, material performance, testing, and polymer technology. And who doesn't have material failure issues??!!

There will be more seminars during the year and we would like to get your feedback on topics you would like to see. A short survey will be send out to the membership in a few weeks. Look forward to your feedback and seeing you at the first seminar for the year. We received tremendous response on our plant tour last year and we plan to organize again one this year. A Golf Outing has been set at Oak Marsh for this summer. Please mark your calendars for August 1.

Our Scholarship program for students in 2 and 4 year degree program has been going strong. We would certainly like more students to apply. Last Fall we gave scholarships to two students from HTC - Marshall Melbie and Kevin Le. Congratulations to both Kevin and Marshall!!

And with that would like to thank you once again for your support. SPE is an organization that is fueled by energy from volunteers and has been my vehicle to give back to the industry that I have learnt and received so much from. Thank you for this opportunity to serve the Upper Midwest Section. Signing off…

Sincerely, Shilpa Manjure

WELCOME TO OUR NEW MEMBERS - Michael Arney, Membership Chair

We are pleased to welcome our newest members of the SPE Upper Midwest Section. As of March 30, 2017, our section has 192 active members. In addition, there are 568 persons in the upper midwest region who are members of SPE, but not affiliated with any section. Please join our section for the best education and networking opportunities! Check out our website, www.uppermidwestspe.org and the national website, www.4spe.org, to know all that SPE and this section has to offer.

New Member	Affiliation
Brian Murray	UW - Stout
Collin Forseth	Hennepin Tech Plastics Engineering
Nick Strandine	UW - Stout
Kyle Johnson	Winona State University
Brian Kautzman	Steinwall, Inc.
Nemat Hossieny	NatureWorks, LLC

Rheological Characterization of Medical Thermoplastic Polyurethanes

Ian Pierson, Emily Chen, Ajay D Padsalgikar
Abbott, Rogers, MN

Abstract

The use of thermoplastic polyurethanes (TPUs) in the medical device industry is widespread due to the unique combination of biological properties, abrasion resistance, and processability that they provide. Phase separation at the microscopic level within the morphology of TPUs results in the presence of hard and soft polymer block segments, creating these desirable characteristics. However, the microphase separation also complicates the understanding of TPU structural properties, particularly their flow properties, and creates difficulties during melt processing. Properties of several TPUs were characterized with a novel rheological method to quantify the effects of time dependence and are reported in this study.

Introduction

Thermoplastic polyurethanes (TPUs) are widely used in many medical devices due to their unique combination of biological and mechanical properties [1- 4]. TPUs are segmented copolymers, consisting of micro-phase separated hard and soft domains. The stiffer hard segment typically consists of an aromatic diisocyanate and a low molecular weight diol called a chain extender. The relatively flexible soft segment typically consists of a higher molecular weight macrodiol.

The polymerization reaction in TPUs can proceed through either a one-step process or a two-step process [4]. The difference between the processes is essentially the addition sequence of the raw materials for synthesis. In a one-step process, all the raw materials for the synthesis are added at once, whereas, in a two-step process, the polyol is first reacted with an excess of isocyanate to produce an isocyanate end-capped pre-polymer. The pre-polymer is then reacted with a stoichiometric quantity of the short chain diol or the chain extender. The pre-polymer can also be seen as the soft segment and the reaction of the pre-polymer with the chain extender as the formation of the hard segment.

Due to the high degree of thermodynamic incompatibility between hard and soft segments, a complex morphology arises within the material. Hard segments separate from the soft segments, aggregating into larger hard domains, but the separation is not complete. Generally, some soft segments remain included in the hard microphase, and some hard segments remain dissolved in the soft microphase. The degree of phase separation can be influenced by the choice of macrodiol for the soft segment, thus creating differences in segment interaction and the polymer properties that depend on it. The chemical composition and relative amounts of both the soft and hard segments can be varied in TPUs to produce widely different final polymer properties.

Many of the desirable properties possible in TPUs are a direct result of the phase separated morphology and the resulting interaction between the hard and soft segments. Soft segment composition tends to have a greater impact on the long term biostability of the polymer, with polysiloxane based soft segments being the most stable [5, 6].

Time Dependence of TPU Rheology

During melt processing, the TPU becomes completely molten and the phase separated structure gives way to a single phase, homogeneous melt. The rheology of TPUs is complex and shows effects not commonly observable in melt rheology of other polymers. Two factors are seen to play a role in this complex behavior, depolymerization and allophanates. During TPU synthesis, the reaction between isocyanate and hydroxyl end groups forms a urethane bond. The urethane bond is itself reversible at high temperatures, and this reversal can lead to a complex rheological behavior. Several studies have looked into the effects of this depolymerization reaction on the TPU melt rheology [7 – 9]. Allophanates are linkages formed due to the reaction between an isocyanate group and an already formed urethane bond. The allophanate reaction occurs as depicted in Figure 1.

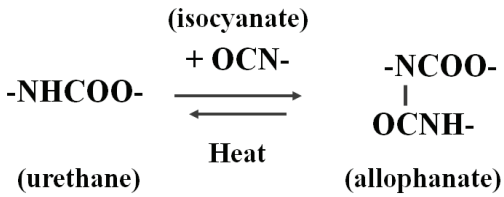

Figure 1: The reversible allophanate reaction, a side reaction between isocyanate and urethane.

Allophanates dissociate at TPU melt temperatures [10] and this dissociation occurs over a period of time, giving rise to the time dependence of TPU viscosity. Time dependence is a factor of the amount of allophanates present in the system, the kinetics of allophanate dissociation and residence time of the melt in the processing equipment. It has been observed that TPU systems with higher incompatibility between the soft and the hard phases show a greater amount of allophanates, such as in siloxane based TPUs [10]. The presence of allophanates also creates effects in the molecular weight of the TPU, as allophanate crosslinks can significantly increase the higher molecular weight component of the TPU. Upon dissociation of the allophanates this component has been seen to reduce [10].

In this study, we examine the time dependence of the melt rheology in TPUs and evaluate the role of allophanates and their dissociation on TPU rheology and processing.

Materials

Five medical TPUs with varying silicone content were studied in this work. Two thermoplastic silicone-polycarbonate-urethanes (TSPCUs), and three thermoplastic silicone-polyether-urethanes (TSPUs) were evaluated; these

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materials and their relevant properties are included in Table 1. All materials are manufactured by DSM, with the exception of Elast-Eon 2A™ which is manufactured by Abbott.

Material Name	Reference Name	Silicone Content (wt. %)
CarboSil™ 20 80A	TSPCU20-80A	20
CarboSil™ 20 55D	TSPCU20-55D	20
PurSil™ 20 80A	TSPU20	20
PurSil™ 35 80A	TSPU35	35
Elast-Eon 2A™	TSPU48	48

Table 1: Materials evaluated in this study.

TSPCUs are formulated with a mixture of polycarbonate based and polysiloxane based macrodiols as the soft segment. TSPUs are formulated with a mixture of polyether based and polysiloxane based macrodiols as the soft segment. The numerical prefix after each material name indicates the amount by weight percentage of the silicone present in the TPU, whereas the hardness value is an indication of the ratio of soft to hard segments in the material. The hard segment for all materials is made up of methyl diphenylene isocyanate (MDI) and butanediol (BDO).

Experimental

Capillary Rheometry

Capillary rheometry was performed for each of the materials previously described. All samples were evaluated using a Rosand RH2200 twin bore benchtop capillary rheometer with 15 mm diameter barrel. All testing was performed with a 1 mm capillary die with a length-diameter (L/D) ratio of 32, and a 138 MPa (20,000 psi) pressure transducer. Rheometer parameters, including barrel temperature and applied shear rate, were set using the rheometer's included Flowmaster™ software program, with shear rate controlled for each run by changing the movement speed of the piston through the barrel. Barrel temperatures were set based on recommended extrusion conditions provided by the manufacturer for each material. All materials were dried under vacuum at 60 ºC until moisture content was measured below 200 ppm by Karl Fischer Coulometry.

In order to accurately characterize the rheology of TPUs across a range of shear rates, a new method was developed to account for the time dependence observed in some of the materials. Prior to initiation of shearing, to start from a point of thermal equilibrium, all materials were compressed to a pressure of at least 0.5 MPa and preheated at the melt temperatures for a total time of 300 seconds. Then, a constant shear rate test was performed, with the shear rate held at a given value for up to 1800 seconds after the preheating phase. Following the collection of shear viscosity data through time for each shear rate, data points at intervals of 100 seconds for each shear rate were compiled into new data sets. These new data sets then showed the shear rate vs. viscosity graph typical of rheological evaluation, but only for the specified time point since the initiation of melting. The set melting time specified by this method ensures that the time dependence of each TPU is captured consistently and can be compared to the rest of the TPUs. The transformation of data sets is demonstrated in Figure 2.

Following the transformation of data into the more typical shear rate vs. viscosity format, a simple power law model was fitted to the data for each material at each timepoint. The data was converted to a log-log plot of shear rate and viscosity, and the slope of the resulting plot used to determine the flow behavior index of each material. Equation 1 gives the basic power law model, and equation 2 shows the logarithmically transformed power law used with a log-log plot,

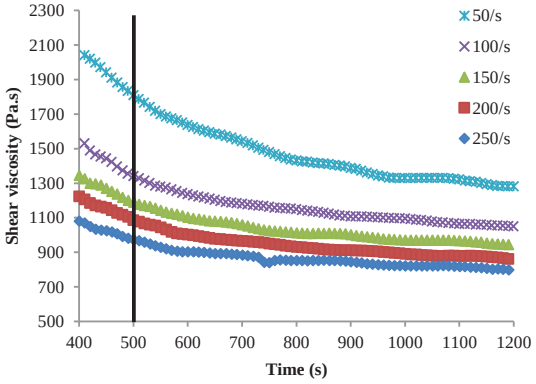
$$\eta = m\dot{\gamma}^{n-1} \quad (1)$$

$$\ln(\eta) = \ln(m) + (n-1)\ln(\dot{\gamma}) \quad (2)$$

where η is the shear viscosity, m is the flow consistency index, n is the flow behavior index, and $\dot{\gamma}$ is the shear rate. From equation 2, the slope of the log-log plot is equal to the flow behavior index minus 1.

Allophanate Titration

Quantification of allophanates was performed on each material by titration of the allophanate bond with dibutylamine (DBA), an established method for allophanate content determination in polymers [11]. 4 grams of the materials was dissolved in 50 mL of dimethyl formamide (DMF) and 5 mL of 2.0 M DBA in toluene. The sample was stirred at 75 ºC for 72 hours to allow all allophanates to react, then 20 g of the sample was transferred to a titration flask and diluted with an additional 70 grams of DMF. The samples, and a blank containing no polymer, were titrated with a Mettler Toledo T5 autotitrator using 0.3 M HCl in methanol as the titrant. The allophanate concentration was calculated from the result of the titration, and each material was tested in duplicate.



(a)

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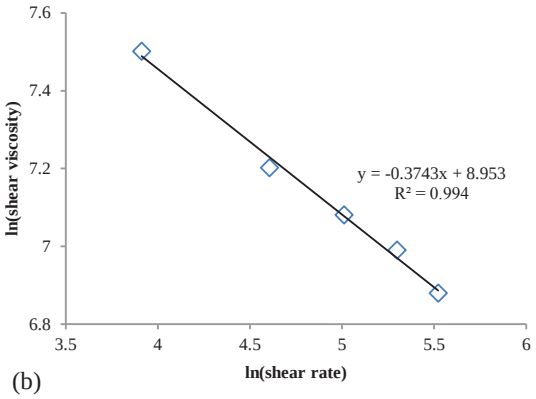

(b)

Figure 2: (a) Example TPU melt viscosity data for constant shear rates from 50 s^{-1} to 250 s^{-1}; black line indicates 500s timepoint used to create new data set of shear rate vs. shear viscosity. (b) Log-log plot of shear rate vs. shear viscosity used to determine flow behavior index of TPU at 500s.

Results and Discussion

The time dependent rheological profile of TPUs is apparent when measured with constant shear rate capillary rheometry. Figure 3 shows the viscosity data obtained over a period of 2000 seconds at a constant shear rate of 50/s for all TPUs evaluated in this study. This shear rate was chosen because it is a typical shear rate seen during extrusion, a common processing method for TPUs. As demonstrated in Figure 3, a constant shear rate method does not give a constant viscosity value that would be expected for a typical polymer melt. The observed decrease in viscosity is due to the degradation of allophanate crosslinks at the elevated temperatures of the polymer melt. However, Figure 3 also demonstrates that not all TPUs exhibit the same degree of time dependence; all materials show a decrease in viscosity with time, but each material decreases by a different amount.

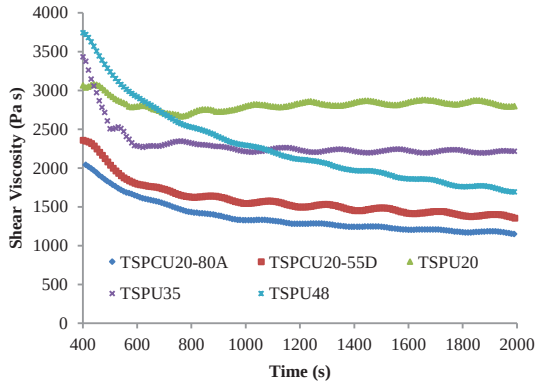

Figure 3: Shear rate vs. time curves for a constant 50/s shear rate for several TPUs.

For each material, the change in viscosity was calculated as the percent difference between the initial and equilibrium viscosity. These values are available in Table 2. Due to slight fluctuations produced by small temperature variations within the rheometer, the equilibrium viscosity was defined as the average of the final 5 viscosity values measured.

Furthermore, the change in viscosity was correlated to the silicone content of each TPU and plotted in Figure 4. For the TSPUs, there is a strong correlation between silicone content and difference between initial and equilibrium viscosity. However, the TSPCUs do not follow the trend of the TSPUs. This is likely due to the difference in soft segment caused by the polycarbonate backbone in the TSPCUs. Moreover, both types of TSPCUs contain 20% silicone and had similar changes in viscosity, suggesting that the silicone content in these materials still influences the time dependence of the viscosity.
Quantification of allophanate content was performed on each material to determine the impact of allophanate crosslinks on rheology. The results of the testing demonstrate that allophanate cross links are present in pellets of each material in a measurable amount. In addition, the amount of allophanates has an impact on the amount of time dependence seen in a given polymer's rheological profile. As the amount of silicone in the material increase, the amount of allophanates measured

appears to show a general increasing trend, with the highest silicone material, TPSU48, clearly having a mujch higher allophanate content than any other material. Table 3 shows the measured allophanate content of each polymer. An additional consequence of the time dependent rheology of TPUs is the variable value of the flow behavior index. Using the method outlined in the experimental section, the flow

Material	η_0, Pa s	$\eta_{equilibrium}$, Pa s	$\Delta\eta$, %
TSPCU20-80A	2066	1163	43.7
TSPCU20-55D	2360	1350	42.8
TSPU20	3080	2667	13.4
TSPU35	3488	2177	37.6
TSPU48	3744	1709	54.4

Table 2: Table of measured initial and equilibrium viscosity values for different TPUs, with calculated difference between the two values.

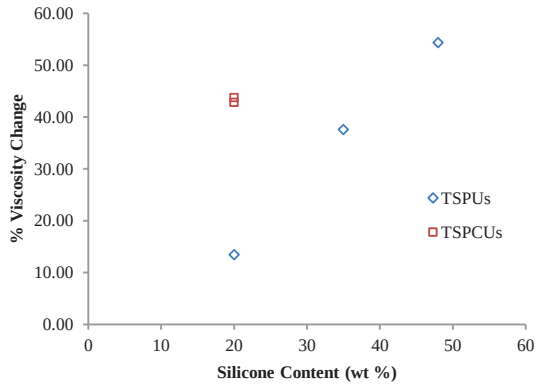

Figure 4: Silicone content vs. viscosity change for all measured TPUs.

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Material	Allophanate Content (wt. %) ± SD
TSPCU20-80A	0.0451 ± 0.015
TSPCU20-55D	0.0471 ± 0.007
TSPU20	0.0672 ± 0.017
TSPU35	0.0731 ± 0.032
TSPU48	0.135 ± 0.009

Table 3: Measured allophanate content for each TPU tested.

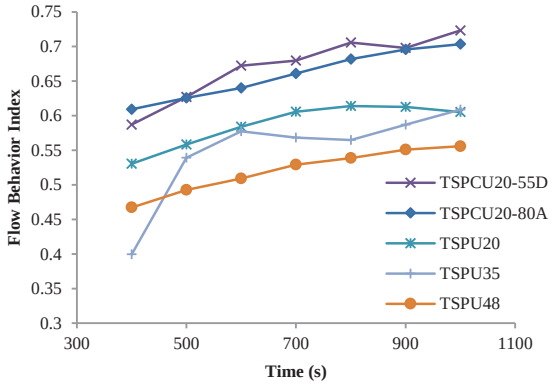

Figure 5: Plot of flow behavior index through time for all materials evaluated.

behavior index was calculated for each material at 100 second intervals, starting at 400 seconds and ending at 1000 seconds. Calculation was ended at 1000 seconds due to limitations imposed by the size of the rheometer; at higher shear rates, the rheometer could only hold enough material for approximately 1000 seconds of shearing. The calculated values for each material were plotted against time in Figure 5. For all tested TPUs, the flow behavior index increased throughout time as allophanate crosslinks broke, lowering the apparent molecular weight of the polymer. With less interaction between polymer chains, the polymer melt exhibits less shear thinning and becomes more Newtonian, as observed in Figure 5.

Conclusions

In this study, we demonstrated and analyzed the time dependent rheology of several TPUs. Data was collected across a range of typical processing shear rates and transformed using a new method into data sets that could be used to accurately describe the polymer melt behavior at a given time and shear rate. In addition, allophanate crosslink content of each TPU was measured to quantify the effect of silicone content on allophanate formation.

It was observed that rheological time dependence is directly related to silicone content in TPUs. As silicone content increases, the soft segment becomes more incompatible with the hard segment, resulting in greater separation between the micro-phases. The direct relationship between silicone content and time dependent rheology was apparent for TSPUs, but was also consistent between multiple TSPCUs with identical silicone content. In the case of the TSPCUs, a direct comparison to TSPUs based on silicone content alone is not possible due to the presence of polycarbonate macrodiol in the soft segment changing the interactions between soft and hard segments. Overall, the increased separation between microphases caused by additional silicone increases the ability of allophanates to form, as measured through quantification of allophanate content by titration.

The quantification of TPU melt rheology using this unique method provides several benefits. This method allows for increased accuracy in the modeling of melt processing operations by taking into account both the shear rate the material experiences and the time the material has been melted. By accurately measuring the time dependence of a given material, a model can more accurately determine the process conditions at a given point and produce a model that more closely mirrors reality.

References

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This Paper will be presented at the upcoming ANTEC, May 8-10, Anaheim, CA

Councilor's Corner

by Tom McNamara - Councilor - Upper Midwest Section

This should be an exciting year from a leadership standpoint. As discussed in the last Councilor's Corner column, a governance task force (GTF) has proposed a new governance model for our Society. The acceptance of the new model was voted on and the Council approved the new model. We are moving from an annual voting of positons on the Executive Committee that had a more "general" role in leadership to an almost corporate structure, which will have defined roles and qualifications defined by job descriptions. The expectations of the new governance board (GB) is to better serve the interests of the Society and provide more transparency and communications, which are essential to maintaining trust throughout the Society.

The composition of the Governance Board will be President, President-Elect, Past President, Chief Staff Executive and VP's of Sections, Divisions, Young Professionals, Business and Finance, Events, Marketing and Communications, and Technology and Education. We have a slate of very good candidates for these positions and the voting has started with the position of President-Elect. This will be followed by voting for the positions of VP - Business and Finance, VP – Marketing and Communications, VP – Events, and VP – Divisions. Because all positions are 2-year terms and we want to have the GB staggered on turnover, we will not vote for VP's of Sections, Young Professionals and Technology and Education until next year.

In addition to the new governance structure, as reported previously, SPE is in search for a new Chief Staff Executive as Wim De Vos has not chosen to renew his contract beyond this year. The Executive Committee is interviewing the initial slate of candidates with the expectation to reduce the number to 3 or 4 to be assessed in a second interview. The goal is to select a leading candidate in May and a new CEO by the end of Q2.

Other activities / announcements:

> The Rochester Section is now active (formerly they were provisional)
>
> The Student chapters at Purdue and Texas A&M are now approved

If you have not already done so, you may want to register for attending this year's ANTEC. It will take place May 8-10 in Anaheim, CA. It is the SPE annual hallmark event with over 600 technical presentations and industry leading keynote speakers. There will also be new technology forums, panel discussions, speed interviews, the plastics race, a women's networking breakfast, and the SPE Awards & 75th Anniversary Gala. If you are trying to get updated on the latest plastics technology and network with industry and innovation leaders, you need to be at this event. To register, just go to www.4spe.org and click on events and then ANTEC.

And my normal pitch - - please be active in your Section. We are always looking for new members and you can help by spreading the word to your colleagues. Also, we are always looking for help on our Board and committees at our Section level. If you are willing to help make our Section more effective for all our members, please contact any Board member on the back of this SPEcialist. Thank you.

SPE Education Committee *– Tom McNamara*

Students – be sure to look at the offerings at ANTEC this year. Once again they are having the Plastics Race and are offering speed interview sessions. They have student activities events and, also, have their annual student awards luncheon. All of this in addition to the 600+ technical talks and, of course, the poster sessions. Be sure to look at the offerings under ANTEC on the SPE website: www.4spe.org.

We will again be awarding the Upper Midwest Section scholarships to the winning students from plastics programs in our Section geographical area. Awards will be presented in April.

In other news, SPI has extended their program to fund student membership fees to join or renew with SPE. Students participating will receive a free SPE student membership in addition to an electronic membership to the Society of the Plastics Industry (SPI). Students who are US citizens with primary residency in the US receive their complimentary membership by simply joining or renewing online. Just go to www.4spe.org and follow the membership instructions. All during the registration it will look like you will be charged $31. However, at the end there will be a check box asking if you want SPI to pay the registration fee. If you check that box, the billing amount should zero. If you have a problem, contact membership services at SPE.

Spotlight on the Board - Ajay D Padsalgikar, Ph.D.

Ajay graduated with a degree in Polymer Engineering from the University of Poona, India in 1990. He then completed a PhD from Clemson University, SC, USA in 1996. In his PhD, he worked on the micro-rheology of polymer blends and their resultant structure formation in the process of fiber spinning. His first work assignment after his education was at the Research & Technology Center in Everberg, Belgium at ICI Polyurethanes.

At ICI, Ajay worked mainly on the processing of polyurethanes, thermoplastic as well as thermoset. In 1999, ICI Polyurethanes became Huntsman Polyurethanes. Ajay's work continued in the field of processing of polyurethanes but became more focussed on computer modelling and simulation of the different processes including polyurethane synthesis.

In the middle of 2002, Ajay joined AorTech Biomaterials in Scotland from where he was transferred to Australia in late 2002. He served as the Chief Scientific Officer of the company and various projects that he was involved with included polyurethane bulk and solution synthesis, chemical engineering of the synthesis of raw materials for polyurethanes, processing of polyurethanes for medical devices.

Ajay joined St Jude Medical in December 2012 as a Senior Principal Scientist and has been involved with material development, application and characterization in the cardiac space.

Ajay joined the Society of Plastic Engineers (SPE) in 1996. He has been an active member of the various sections, the Benelux section in Europe and the Australia-New Zealand section. He is currently affiliated with the upper Midwest section of the USA. He is also active in the Medical Plastics division. Membership in the SPE has been a great source of education, conferences and networking for Ajay.

Ajay has more than 30 published scientific papers and 10 patents.

WHO CAN HELP YOU

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April 2017

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POSITIONS WANTED ON THE BOARD

Open currently or Soon to be available

Membership Chair
House Chair
Other Board Directors for various sub-committees

Tenure: 1-2 years depending on position and sub-committee

Qualifications Needed: SPE member; part of the plastics industry; enthusiastic, accountable, and passionate about plastics educations of the community

Contact: Shilpa Manjure (smanjure@ntic.com)

CALENDAR OF EVENTS

Minitec ..... April 27, 2017
ANTEC 2017 ..... May 8-10, 2017
Golf Outing ..... August 1, 2017
Plant Tour ..... October 2017
Megatech ..... October-November 2017

Upper Midwest Section (S22) Membership

March 30, 2017

Section Total

568