ASM INTERNATIONAL Pune Chapter

Chapter News Letter

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Editor
Udayan Pathak

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EDITORIAL . . . ✍

Hello Friends,

It's my immense pleasure to present the first News Letter of New Year 2019. It will be released during Inauguration of Two Days International Conference M&MT 2019 with Special Focus on 3D Printing AtoZ.

Dr David Ulrich Furrer, FASM has taken over as 2018 - 2019 President of ASM International. William E. Frezier, FASM outgoing President introduces him to all of us. The first part of the article is included in this news letter. We are sure under David's leadership ASM International will flourish it's activities.

Rheological Fluids are finding it's place in Shock Absorbers and other applications of Automotive Industry. Micro-rheology using 0.2 to 3 microns diameter tracer particle is emerging as new avenue. We are reproducing article from LSI.

Lady Metallurgists have contributed immensely for development of Metallurgy in India. We are happy to introduce Chhaya Kulkarni Rajput, the first Female Student from VRCE (Now VNIT) Nagpur. Her narration will be inspiring story for all of us.

Vaibhav Chiplunkar is Executive Committee Member who figured in Know Our Member column.

Students are the Focus of ASM Pune Chapter. Photo feature is covering Lectures by Chapter Chairman B R Galgali and Treasure Y S Gowaikar on Career Opportunity and Modern Metallography Techniques in Govt. Polytechnic Pune and Udayan Pathak'slecture for Metallurgy Students at Govt. Polytechnic Nagpur on Failure Analysis.

Our training Program on Failure Analysis had good response as usual. The feedback from delegate is also encouraging.

Your suggestions to improve this news letter, technical articles are always welcome for Chapter News Letter.

Udayan Pathak, FASM
Editor

2018-2019 PRESIDENT OF ASM INTERNATIONAL

DAVID ULRICH FURRER

William E. Frazier, FASM, 2016-2017 ASM President

I am honored to have the privilege of introducing the 2018-2019 president of ASM International, Dr. David Ulrich Furrer, FASM. Friends, colleagues, and coworkers who know him well can attest to the fact that he is both a strategic thinker and a man of passion and intellectual curiosity. He is an extremely accomplished, ethical, and assiduously hardworking individual.

Dave is originally from Wisconsin and attended the University of Wisconsin–Madison. He may frequently be heard to proudly proclaim, “Yes, I am a Badger!” Dave met his wife Patti during his time at the university, and this is also where he became fascinated with materials while studying under Professor John Perepezko. Dave went on to receive a doctorate of engineering from Ulm University in Germany where he studied microstructural evolution in superalloys under the guidance of Professor Hans-Jörg Fecht.

MATERIALS CAREER PATH

Dave began his professional career at Pratt & Whitney in West Palm Beach, Florida, where he worked on advanced materials and atomization process development. He says it was just too hot in Florida for a Wisconsin guy, so he returned to his home state and joined Ladish Co. Inc. (now ATI Forged Products) in the cooler climate of Cudahy, where he honed his skills in deformation processing by working on nearly every conceivable aerospace alloy. After several years, Dave had an opportunity to join Rolls-Royce where he was able to pursue his passion for modeling and simulation.

He subsequently rejoined Pratt & Whitney where he is currently the senior fellow discipline lead for the company’s Materials and Processes Engineering organization. In this role, he leads a range of technology initiatives related to advanced materials and manufacturing

Dave and Patti Furrer at Banff National Park.

technology. He is focused on efforts to develop and implement step-change capabilities through utilization of data, data analytics, and computational modeling, including high temperature materials development, additive manufacturing methods development, and manufacturing process control and feedback systems.

Dave is a visionary with a long track record of working on cutting edge technologies. For example, he was active in the area of integrated computational materials engineering (ICME) before the acronym ICME had even been formulated. Because he was intrigued with computational modeling and how it could be used to generate materials, processes, and high performance components, he supported the development and linkage of materials and process models to enable location-specific property prediction. He also applied neural network models to complex materials and processing systems in order to tease out relationships of parameters from practical material and manufacturing datasets.

CAPTURING IMAGES FOR ART AND SCIENCE

In addition to his technical interests, Dave is an avid amateur photographer and metallographer. He has captured many beautiful images of the moon, aircraft, cityscapes, animals, and even the iconic ASM dome. His professional interests now extend to the translation of metallographic images into a digital format suitable for analysis by machine learning and deep learning tools. Applying these tools will enable microstructures to be readily analyzed and classified in much finer detail than could ever be done by humans. Dave loves microstructures but says, “These are now art for my walls.”

COMMUNITY LIFE

Community has always been a big part of Dave’s life. He was a member of the U.S. Air Force Reserve 440th Airlift Wing Community Council and has served on a number of university and industrial advisory boards. He enjoys sharing and teaching others, and has served as an adjunct assistant professor at the Milwaukee School of Engineering where he taught materials and manufacturing courses to mechanical engineering students.

The ASM family is also an integral part of his community. As a previous member of the Milwaukee Chapter, he served as chapter chairman and held many other executive committee positions as well. In this capacity, he worked with a team of outstanding chapter leaders to deliver the annual H.R. Bergmann Memorial Seminar and coordinate the Ernie Guenther Memorial Scholarship Fund. The fund annually provides student scholarships and high school teacher grants. As an ASM volunteer, Dave has served on the Advanced Materials & Processes editorial committee and on ASM’s content and handbook committees. He also served as the 2012 AeroMat conference chairman, led the development of two ASM Handbooks, and has authored numerous papers.

Dave is an avid amateur photographer in his spare time. From left, Boston reflection, F-35 fighter jet, backyard friend.

As we move into the third year of the ASM Renewal, Dr. Furrer is definitely the right person to move our society boldly into the digital future. As an accomplished, ethical, and strategic thinker who is passionate about his community, Dave is well equipped to be at the helm of our great technical society.

Source : AM&P Feb 2019.

(To be continued in next issue.....)

Know Our Members

Vaibhav Chiplunkar

VaibhavChiplunkar is Technical Head, Industrial Lubricants, Rohan Enterprises (HP Dealer). He is Executive Committee Member of ASM International Pune Chapter. He is alumnus of College of Engineering and Govt. Polytechnic Pune.

Vaibhav started his Career as Shift Engineer in Antifriction Bearing Corporation later moved to Trinity Thermal. He made carrer shift to Technical Marketing leveraging his Heat Treatment shop Floor experience. He worked for Hardcastle & Waud Mfg. Co., PCP Chemicals Pvt Ltd, Sah Petroleum Ltd., Protochem Industries P. Ltd., Kalyani Technotherm Ltd., Arabian Petroleum Ltd. His focus was supporting customer for migration to new Gen Quenching Systems (Hot Oils, Cold Oils, Polymers etc.) to attain finest quality in Heat Treatment. He also supported customer to choose right furnaces and helped them to establish it. He is based in Pune, and catering Pan India Heat treatment units, both Captive & commercial Heat treaters.

Lecture by B R Galgali and Y S Gowaikar in Govt. Polytechnic Pune.






Training program "Failure Analysis including Auto & Engine Components"

Training program "Failure Analysis including Auto& Engine Components" was conducted jointly with ARAI during 12th to 14th Dec 2018, ARAI – FID Chakan. Forty five delegates participated in the program pan India. Overall rating of the program was 8.2 on 0 – 10 scale. Some remarks from participants were –

'Well arranged', 'Faculty was good and well experienced', 'Good course', 'Huge experienced speakers' , 'Enthusiastic speakers & punctuality', 'Practical case studies', 'basics concept are well explained', 'Overall program was good and the faculty as well', 'Very useful to know required approach for any failure analysis'.

Udayan Pathak, FASM deliverying lecture on Innovative Manufacturing Technology for Staff and Students of Mechanical Engineering Govt. Polytechnic Nagpur.


What is Microrheology?

Microrheology

Microrheology is a form of rheology that uses colloidal tracer particles, dispersed within a sample, as probes. The tracer particles (with diameters ranging from 0.3 to 2.0 μm) can be an inherent part of the system being studied, as in suspensions and emulsions, or artificially inserted into the system by the examiner.

The rheological properties of the sample are then determined by examining the motion of the tracer particles in their local environment. For a purely viscous sample the tracer particles diffuse freely through the entire sample (Fig. 1a), making particle mean square displacement $\langle \Delta r^2(\tau) \rangle$ linear with time (red line in Fig. 2a).

$$\langle \Delta r^2(\tau) \rangle = 6D\tau$$

where D is the particle diffusion coefficient as expressed by the (Standard) Stokes

Einstein equation:

$$D = \frac{k_B T}{6\pi\eta R}.$$

Fitting the measured $\langle \Delta r^2(\tau) \rangle$ with these equations yields the viscosity η of a Newtonian solvent containing tracer particles with known radius R. However, in the case of a material containing elastic components, the $\langle \Delta r^2(\tau) \rangle$ shows a more complex time dependency, which makes the above equations not generally applicable.

Figure 1: a) Particles freely diffuse in purely viscous liquids and can explore the whole sample.

This complexity can be shown through the example of a gelatin solution containing polystyrene tracer particles. At higher temperatures (e.g. 50 °C), the gelatin solution behaves purely liquid and the tracer can diffuse freely (Fig. 1a).

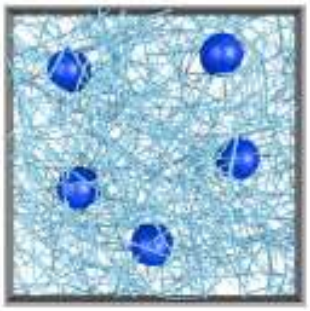

Figure 1: b) Particles trapped in a gel network.

However, when the temperature is lowered to around 15 °C, the gelatin gelates and the tracer particles cannot move within the network (Fig. 1b). There will always be some thermal energy (Brownian motion), but this only allows local deformation with amplitudes that depend on the stiffness of the local environment.

This restricted motion of the tracer particles is reflected in the plateauing at the amplitude of the maximal displacement in the chart of mean square displacement $\langle \Delta r^2(\tau) \rangle$ (blue line in Fig. 2a). This is characteristic of the strength of the gelatin network. Not all materials exhibit one extreme or the other though, with many being complex fluids that demonstrate both viscous and elastic behaviors.

Viscoelastic Materials

Viscoelastic materials have a response that typically depends on the length and time scale probed in the measurements. A natural way to incorporate viscoelastic behavior is to generalize the Stokes-Einstein relation [1]

$$G^*(\omega) = \frac{k_B T}{\pi R i\omega \langle \Delta r^2(i\omega) \rangle} = G'(\omega) + i\, G''(\omega).$$

This equation allows the frequency-dependent storage G′(ω) and loss G″(ω) moduli to be calculated from the measured $\langle \Delta r^2(\tau) \rangle$. In the previous example of the gelatin solution, the values obtained for G′(ω) and G″(ω) using microrheology can be seen in Fig. 2b. At high temperatures (red line) G″(ω) is proportional to the frequency ω, indicating pure liquid behavior, with G′(ω) being very small and out of plotting range.

However, at low temperatures (blue lines), G′(ω) is far superior to G″(ω) over an extended frequency range; only at very high frequency, a crossover to a domain where G″(ω) is larger than G′(ω) is observed. This behavior may be

approximately described by the KelvinVoigt model (Fig. 2c), a theoretical model that combines both viscous and elastic behavior. The model consists of a spring and dashpot connected in parallel, where the spring stands for elasticity of the gelatin network, and the dashpot represents a viscous damper that describes the dissipative effect of water around the gelatin network.

Active and Passive Microrheology

Most microrheology methods can be termed "passive," as the tracer particles they use rely exclusively on thermal energy (i.e. Brownian motion) for displacement within the sample. Some specialized methods (e.g. optical tweezers, magnetic microrheology) are "active."

Active microrheology uses an external force (optical, electric or magnetic) to move the tracer particles with energies that are greater than the thermal energy K T. This gives the advantage of being able to control the amplitude of the particle displacements, which allows performance of both linear and nonlinear rheology.

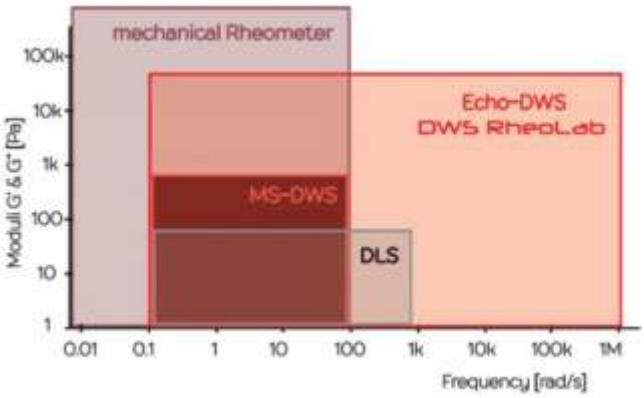

Figure 3: linear viscoelasticity range accessible through mechanical rheometer, MS-DWS, DLS and EchoDWS RheoLab.

On the other hand, passive microrheology is perfectly suited for measurements in the linear viscoelastic region (LVR) as the weak thermal energy K T ensures small amplitudes in the displacement of the tracer particles.

Microrheology can be further differentiated by the method used to measure $\langle \Delta r^2(\tau) \rangle$ the of the tracer particles.The most common techniques are particle tracking, DLS microrheology and DWS microrheology[2].

Comparison of Techniques that Characterize Rheological Properties of Materials

A comparison of the available techniques used to characterized rheological properties of materials is shown in Figure 3.

As Fig.3 shows, the DWS RhoLab, due to its patented Echo technique, can cover a huge frequency range and measure large moduli in samples such as firm gels and concentrated polymer solutions.

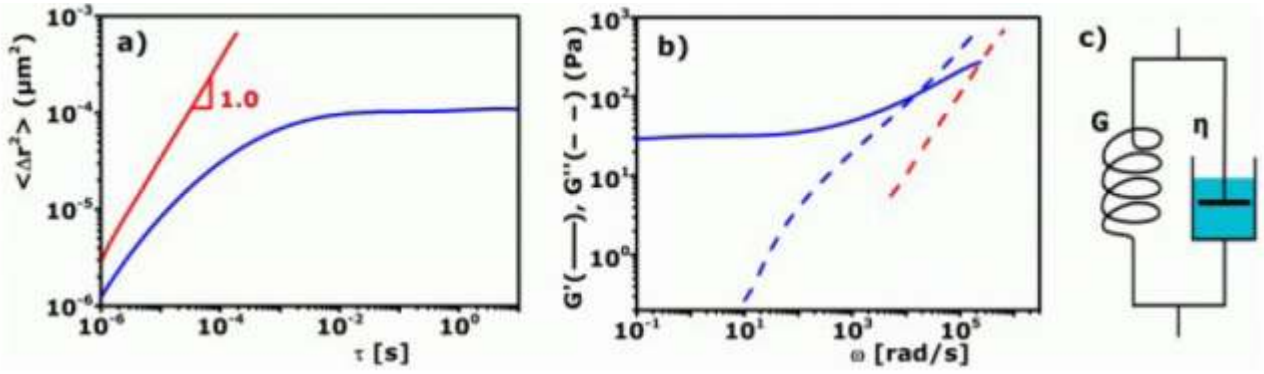

Figure 2: a) Mean square displacement $\langle \Delta r^2(\tau) \rangle$ from freely diffusing (red) and trapped (blue) particles. b) Storage G'(ω) and loss G"(ω) moduli from freely diffusing (red) and trapped particles (blue). c) KelvinVoigt model consists of a spring and a dashpot connected in parallel.

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[1] T.G. Mason and D. A. Weitz: Optical Measurements of Frequency-Dependent Linear Viscoelastic Moduli of Complex Fluids, Physical Review Letters 74, 12501253 (1995).

[2] B.W. Mansel, S. Keen, P.J. Patty, Y. Hemar and M.A.K. Williams: A Practical Review of Microrheological Techniques, Rheology New Concepts, Applications and Methods,

Associate Prof. Rajkumar Durairaj (Ed.), ISBN: 9789535109532, InTech, DOI: 10.5772/53639 (2013)

This information has been sourced, reviewed and adapted from materials provided by LS Instruments.

LADY METALLURGISTS SPEAKS

I joined metallurgy branch, thinking that it's a new field, and became the first lady metallurgical engineer to graduate from VNIT (then VRCE) Nagpur in 1969. I graduated with distinction and merit. Credit for my joining engineering goes to my father (Mr L A Kulkarni) and eldest brother (Mr S L Kulkarni). They always encouraged all of us to study and guided us from young age. I was fairly good in maths and I thought that's the only requirement to become an engineer, and decided when I was in 8th standard, to be an engineer.

My first job was in Aeronautical Development Establishment (ADE), a premier DRDO Laboratory in Bengaluru (then Bangalore) as Scientific Assistant. In my first visit itself, I was fascinated by Bangalore's pleasant weather, its cleanliness, greenery and rich culture. Those days, ADE was in an infant stage and Projects were mainly towards indigenization, with limited budgets. My earliest assignments included working on nickel silver application for aircraft industry. I also actively contributed towards a pilot project of making honeycomb panels for aircraft floor boards. There was an urgent requirement to qualify vendor supplied materials. Thus it became necessary for me as a metallurgist to take over chemical analysis laboratory for quality control for materials used in ADE projects. Further, I had set up an instrumental analysis laboratory, which included spectroscopic analysis and also other material testing facilities. (Pic 1)

My assignments on environmental testing and on corrosion gave me an opportunity to visit INS Vikrant and Frigate. This led me to taking a step towards materials technology. I did my post graduation from IIT Madras in Materials Technology and started working on aircraft materials. ADE was growing and was taking up newer and bigger projects and so my work challenges were also increasing. Now the era of computer card punching was over and Personal computers were used. ADE acquired a Computer controlled Materials Test System. Non metallic materials like, GFRP, CFRP, Kevlar, Foams and Sandwich structures were extensively used in ADE projects and qualification of these materials and their components were required to be done by me. I significantly contributed towards characterization of dynamic properties (damping properties of Kevlar), mechanical properties of natural fibers like Sisal and Jute. I was in- charge of materials Qualification laboratory, with extensive application towards meeting requirements of Unmanned Aircraft Systems (UAS) projects of ADE and other sister DRDO Labs with their test requirements for materials and systems. An innovative application of Materials Test System (MTS) in dynamic testing, involved simulating earth quake effect towards environmental qualification on electric motors (a student project, part of student outreach effort of our Lab). I was actively involved in acoustic signature data collection of various aircraft as part of technology demonstration project. Specifically, this work involved flight trials over land and sea. Interaction with other DRDO labs gave me good experience and exposure. Since I worked mainly in materials science area, there was always an advantage to me, using metallurgical engineering background for visualizing testing set up, testing and analyzing. Particularly in failure analysis it was of great help. (Pic 2)

In DRDO, there is no special advantage to any lady scientist. I had opportunities to travel to different DRDO Labs, Defence units and establishments all over India. DRDO gives all facilities to everyone. I remember, there was some voltage fluctuation problem in our area, so I have to go to lab as early as 5AM. Also during field trials, going to lab at 9PM for certifying airworthiness of components was a pleasure. Of course other scientists were working all through in the night for field trials. Defence Research itself was a big limitation. It is still an evolving field. Interaction with Industry & academics is limited, which has opened up now. I do regret for not continuing on honeycomb project due to some issues. (Pic 3)

How many people do you work with? This question really set me thinking. In last 50 years, my professional life & social life is so intermingled. I stayed in DRDO residential complex for almost 23 years. Today I have professional friends & family friends all over the Globe – from Australia, New Zealand, Norway, USA, Canada, to name a few. Since all projects of DRDO are towards meeting requirements of Defence, I had lots of interaction with defence personnel. I have worked with a large number of Army, Air Force & Naval officers who have now retired in very senior positions. I have worked with many groups and in different projects with many colleagues. ADE and DRDO became known all over the world, and many great scientists have worked in DRDO. Bangalore hosts many seminars and conferences throughout the year. My interactions during seminars and conferences led to my interest in event management, and now it's one of my hobbies and I have friends all over the globe. During international conferences, it was a great pride introducing Indian culture to them e.g. a few foreign lady speakers

enjoyed wearing Sarees. I had been associated in organizing Aero India technical seminar (a biennial event). I still continue as a coordinator of International Conference on Electromagnetic Interference and Compatibility (INCEMIC). I enjoy reading and travelling.

I had a dream of becoming an Engineer. During sixties, it was not easy for a lady to join engineering college, but I pursued my dream and succeeded in overcoming challenges. At the end, I would like to emphasize to all, not to ladies only or not restricted to metallurgists only. "Do not follow a traded path. New avenues and ventures do have troubles and challenges, but follow your dreams. Think of future requirements and pursue new ideas."

" Chhaya Kulkarni Rajput is reachable on c_rajput@yahoo.com"

Volunteer yourself for your Chapter!

For more efficient working & expanding network of your ASM International Chapter, please support your chapter by offering your time. Lot of avenues to choose areas of your liking. Options are - Membership Development, Education Programs, Students Outreach, Member Service, Website, News Letter, Technical Program and Social Events. Contact ASM International Pune Chapter asm.pune@gmail.com

Pic 1. Chhaya Kulkarni Rajput in 1973

Pic 2. Onboard during sea trial with test set up inset

Pic 3. Chhaya Kulkarni Rajput in 2008

Chhaya Kulkarni – Rajput is the First Lady Metallurgy Student of VRCE (Now VNIT), Nagpur.

ASM International Pune Chapter Chairman, B R Galgali, Secretary Rahul Gupta met Crispin Simon from British Deputy high Commissione Mumbai alongwith Sandeep Deshmukh for understanding and spreading Graphene Technology with University of Manchester United Kingdom

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★★★★★ FIVE STAR CHAPTER

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