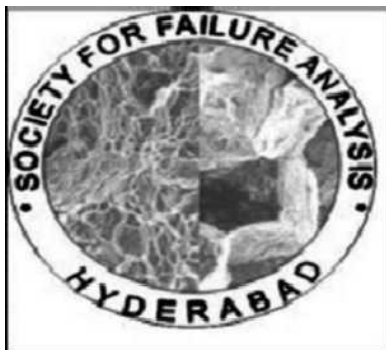




[About SFA](#)

[Objectives](#)

[Local centers](#)

Welcome you all to join as members of SFA! Please find the membership form inside; kindly fill in and contact Secretary of SFA through email.

Experts and experiences:

Dr.G.Ravichandran, BHEL,
Trichy



Message from our President

Dear friends and colleagues,

Seasonal Greetings to all of you. The current month, February in the history see two eminent world class engineers being remembered for their excellent contributions-(i) understanding the moment in structurals using mathematics (Prof Hardy Cross) and (ii) inventing dummy test methods for safety of cars, parachutes and jets (Prof.Samuel Aldeson). The contributions inspire every one of us. The Society for Failure Analysis has been considering nurturing the noble cause of integrating and networking the professionals engaged in engineering so that we can understand failures well in advance through simulation and prediction methods.

I am happy to note that our Chapters are working in this direction by organizing events of relevance for our members in the first instance and further drawing the attention of others thus strengthening our integration of professionals and improve our technical exchange.

I appreciate Chennai Chapter for its efforts in particular in bringing the Newsletter. I am happy to observe the efforts of newly formed Kanpur Chapter in arranging the Workshop in conjunction with the visit of Prof.Wanhill of the Netherlands.

I request every one of you to make conscious effort in helping the Society in its growth. I hope that with your support the Society will make strides which would further generate activities for SFA in newer domains.

With Best wishes to all the readers!

Yours sincerely

(P.Jayapal)



From the Desk of Editors

Warm greetings! We are happy to present you the sixteenth issue of the newsletter of Society for Failure Analysis (SFA).

Among the efforts taken to build the society over the last few months, activities by our local chapters at various places, organizing workshops for inspiring the young engineering professionals. These efforts have really yielded fruits that currently in the last few months, each of the chapters of SFA at Kanpur, Chennai and Trichy organized a national event respectively. We provide a glimpse of the programs conducted at these places in this issue as reports.

We have solicited articles from experts, particularly on the subject from Dr Ravichandran, BHEL, Trichy. While we thank him, I request all of you offer your feedback.

We take this opportunity to appeal to the Indian industry to use SFA as a forum to share their experiences on trouble shooting. A great way to add content to this

newsletter is to include a calendar of upcoming events. The details of important forthcoming international and national events are included along with; the books recently published on the topics of the subject.

We value your comments, which really boost our enthusiasm to perform better. Therefore, as always, your views and comments, mailed to param@igcar.gov.in are welcome. We wish you all free from failures and a joyful life!

You may visit our web site for your comments/suggestions or any queries : www.sfaindia.org

Kalpakkam

28-02-2017 (P .Parameswaran)

Editor

We encourage you to join the society, Kindly fill up the application form (enclosed at the end of the newsletter) and contact secretary:, post your application with draft to Sri.Jana, Treasurer, SFA, RCMA (Materials), CEMILAC, Kanchanbagh, Hyderabad, 500 058



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Editors of Newsletter:

Dr.M.G.Pujar, IGCAR
 Dr.P.Parameswaran, IGCAR

About the society**Aims and Objectives of Society for Failure Analysis**

The aims and objectives of the Society shall be:

To serve as National Society to promote, encourage and develop the growth of "Art and Science of Failure Analysis" and to stimulate interest in compilation of a database, for effective identification of root causes of failures and their prevention thereof.

To serve as a common forum for individuals, institutions, organizations and Industries interested in the above.

To disseminate information concerning developments both in India and abroad in the related fields.

To organize lectures, discussions, conferences, seminars, colloquia, courses related to failure analysis and to provide a valuable feed back on failure analysis covering design, materials, maintenance and manufacturing deficiencies / limitations.

To train personnel in investigation on failures of engineering components and their mitigation.

To identify and recommend areas for research and development work in the Country relating to failure analysis.

To establish liaison with Government, individuals, institutions and commercial bodies on failure analysis, methodologies and to advise on request.

To cooperate with other professional bodies having similar objectives.

To affiliate itself to appropriate international organization(s), for the promotion of common objectives and to represent them in India.

To organize regional chapters in different parts of the country as and when the need arises.

To do all such other acts as the Society may think necessary, incidental or conducive to the attainment of the aims and objectives of the Society.

Know your
local
centers





Failure analysis– a mechanical engineer's perspective

Dr G Ravichandran, BHEL, Trichy

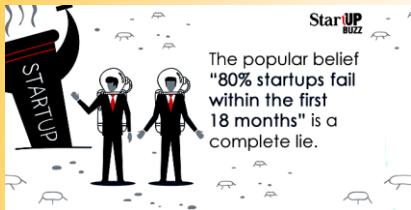
Failure of an industrial component is related to its functionality and any premature failure can have very serious repercussions like the loss of human life and financial losses. Hence utmost care has to be taken in making a detailed analysis into the root causes of the failure to avoid recurrence of the same in future components. While the failure analyst is generally a metallurgical engineer who goes into the metallurgical causes of failure, a mechanical engineer is expected to come up with a design of the component which eliminates the chances of such failures in future components. The design process is thus iterative in nature with the design getting refined whenever the design engineer gets a new piece of information on the functioning of the component. The mechanical engineer should have a close understanding of the failure mechanisms in a variety of cases like static or fatigue loading, ductile or brittle behavior of

components containing notches and cracks etc.

The design of statically loaded component is fairly simple and the design engineer has to apply a reasonable factor of safety in the design process so that the component is not unduly heavy and the various uncertainties associated with the loads are adequately taken care of. Even though the behavior of a static loaded component is generally expected to be ductile, the design engineer must be careful about components containing sharp notches which are subjected to impact loads especially when dealing with notch sensitive materials. When the material of the component is ferritic in nature and the operating temperatures are lower, the design engineer must ensure sufficient safety margin between the design operating temperature and the ductile to brittle transition temperature of the material.

The design process generally





assumes a single value for the loading as well as the resistance offered by the component but in reality, there may be a large scatter in the loading and resistance offered. Whenever the load acting on the component is in excess of the resistance offered by the component at any point of time during its entire design life, there is a possibility of failure. While the design engineer has little control over the scatter in the driving force which is acting on the component, he can minimize the scatter in the resistance of the component through better quality control checks. The scatter is caused by many uncertainties like the anisotropic behavior of the material, presence of residual stresses at critical locations, distortion in the component, degradation in properties of the material over time etc. While the factor of safety generally takes care of such uncertainties, the designer must have a good understanding of the effects of such phenomena and must specify the acceptable limits for each of the above factors. Numerical techniques like finite element method and experimental techniques such as strain gauging help a design engineer in developing better understanding of

many phenomena but the designer should also know the limitations of such methods.

Components subjected to fluctuating loads pose additional problems for the design engineer as the fatigue phenomenon is associated with high level of scatter of the life of the component. This is more so in the case of welded structures and the designer should know the quantitative effect of various factors on the fatigue life of the component. He must particularly be careful about the notch effect produced by many geometric stress raisers in a weldment. The design of fatigue loaded components is performed taking into consideration a given probability of failure. General engineering structures are designed with a probability of failure of 2.3% whereas more critical components call for even more stringent factors. There are many fatigue life improvement methods in vogue and the design engineer should have the necessary knowledge to account for their influence in the design calculations. In the case of

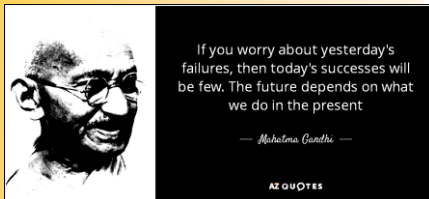




randomly loaded components subjected to varying levels of stress ranges, the counting of cycles for a given interval is another challenge. The assessment of damage in such component over a period of time and predicting the remaining safe operational life are the areas which are expected of the design engineer.

The design engineer must also be aware of the recent advances in the theory of fracture mechanics which is widely employed for

remaining life assessment studies. The critical size of the crack to cause stable or unstable fracture in the component, rate at which the existing crack grows during service are some of the information needed for the design engineer to assess the remaining safe life of the component. Thus a design engineer is expected to have deeper knowledge in various disciplines to avert any failure of the component by suitable design of the component.



National Workshop on Failure Analysis of Aircraft Structures (FAAS-2016) at IIT , Kanpur, Nov 7-8, 2016

SFA, Kanpur Chapter conducted two days workshop utilizing the visit of Prof Wanhill, an eminent failure analyst of The Netherlands during Nov 7-8, 2016. The workshop was inaugurated by Prof.I.Manna, Director IIT Kanpur. Sri.P.Jayapal, President, SFA graced the function as chief guest. The lectures were delivered by Prof Wanhill, Dr.N.Eswara Prasad (DMSRDE), Prof. Venkitanarayanan (IIT Kanpur), Dr.P.Parameswaran (IGCAR, Kalpakkam) and Mr Praveer Varma, DMSRDE. The participants totaling 80 were drawn from IIT, Kanpur, DMSRDE and nearby institutions who participated and interacted very well with the speakers.





Current Practices and Trends in Engineering Failure Analysis” at GRT GRT Institute, Tiruttani, Tamilnadu

A one day theme meeting on “Current Practices and Trends in Engineering Failure Analysis” was conducted on Dec 24, 2016 jointly by SFA, Chennai Chapter and GRT Institute of Engineering and Technology (GRTIET) at GRT Institute, Tiruttani. This theme meeting was specially organised for the faculty members, post-graduate students and research scholars of Mechanical Engineering, Manufacturing Engineering and Automobile Engineering. Following the welcome address by Dr. C. Viswanathan, Chairman, R&D Cell, GRTIET and felicitations by the Principal, GRTIET with an address to the participants. Dr. B.P.C. Rao, Chairman SFA Chennai Chapter and Head, NDE Division, IGCAR delivered a keynote talk on “Importance of Engineering Failure Analysis”. Stressing the role of failure analysis in failure prevention, Dr.B.P.C Rao gave an overview of the art and science of investigating a failure and highlighted different tools and evaluation techniques employed for identifying the root cause of failures. The second lecture was presented by Dr.P.Parameswaran, IGCAR on “Methodologies of Systematic Failure Analysis” in which he highlighted the role of optical/electron microscopy for microstructural examination. He stressed the importance of metallurgical aspects in proper design and manufacturing of components and presented a few case studies of failures in components due to deficiencies in design, choice of material and manufacturing.

The third lecture by Shri G.S. Shankar, Caterpillar, Chennai dealt with on 3

case studies of failure analysis on castings and forged components of earth moving equipment. The lecture threw light on the process metallurgy deficiencies that result in failures. The next lecture was delivered by Shri.N.Raghu, IGCAR on various non-destructive testing (NDT) techniques employed during failure analysis. He presented the principles and the application of several important NDT techniques. The final talk on “Fracture and failure- an Overview” was delivered by Dr.V.Karthik, IGCAR who covered various modes of failure under tensile, fatigue, creep and impact loadings, crack initiation & propagation and unique signature marks on fractured surfaces. 35 faculty members of GRTIET attended this theme meeting and interacted with the speakers through questions and lively discussions. The participants gave a positive feedback for the theme meeting. Dr. R. Selvakumar, GRTIET thanked SFA and IGCAR engineers for accepting their request conducting this special theme meeting for the benefit of their faculty and students.



“Success is the problem but failure is the FORMULA.. You can't solve the problem without knowing the FORMULA..”

Rosh
Friday - Aug 10, 2016 (8:42 pm)



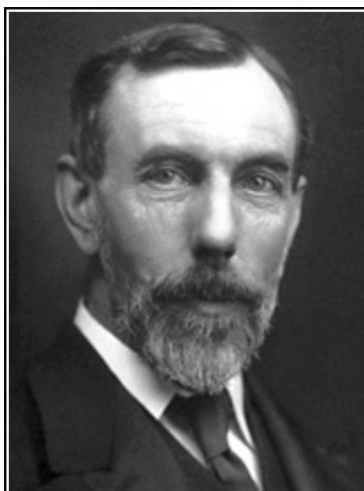
Seminar on Failure Analysis at Caterpillar India, Chennai

One day seminar on failure analysis was conducted on 13th September 2016 at Caterpillar India Pvt. Ltd, Chennai. The event was organized by SFA Chennai Chapter along with Caterpillar India. The technical program consisted of talks on overview of failure analysis with practical examples from the case studies by faculty from Caterpillar, IGCAR and IIT Madras. The program started with a welcome address from Shri. G. Shankar, Divisional Manager, Caterpillar India. He welcomed all the delegates and thanked them for such an overwhelming response to the event invitation. Dr. BPC Rao, Chairman, SFA, Chennai Chapter & Vice-President, SFA gave the introductory speech emphasizing the need for failure analysis. He stressed upon the need for conducting this kind of events for the benefit of members of SFA. He pointed out that such events help in bringing engineers from IGCAR, IIT and Caterpillar together irrespective of the fact that each has a completely different nature of work. He also praised the exceptional work done by the executive committee members, especially Dr.P.Parameswaran, for SFA.

Shri Fanish Tiwari, Caterpillar India delivered the first talk and discussed about the steps to be followed for

fracture surface analysis. He discussed about how to identify signature marks of each fracture surface and classify them as ductile, brittle or fatigue fracture. The second lecture was given by Dr.Parameswaran who briefed about various failure studies in stainless steel and explained how SEM and TEM have been used effectively in his failure analysis and to conclude on the root cause. The next talk was given by Shri.C.Mahendrarvarman of Caterpillar India. He discussed in detail about different types of weld failures in earth moving equipment. Next talk was delivered by Prof. Raghu Prakash, IIT Madras and Vice Chairman SFA, Chennai Chapter. He discussed in details about the fatigue fractures and problems related to loads, inspection, maintenance and repair of the parts. He explained Linear Elastic Fracture Mechanics and its use to develop damage tolerant design. Last talk was given by Dr. V. Karthik, IGCAR who discussed various novel techniques used in miniature sample testing of industrial parts. All the talks were well received and appreciated by the participants who came from Caterpillar, GRT Institute of Technology, CVRDE, Anna University, IGCAR and IITM. The event was concluded with vote of thanks by Shri. Fanish Tiwari, Secretary SFA Chennai Chapter.





Progress is made by trial and failure; the failures are generally a hundred times more numerous than the successes ; yet they are usually left unchronicled.

— William Ramsay —

AZ QUOTES

Donald “Don” J. Wulpi

Donald “Don” J. Wulpi, FASM, passed away on September 4, 2016, at the age of 92, in Fort Wayne, Indiana. A graduate of Lehigh University, with a degree in metallurgical engineering, Don was widely recognized for his notable contributions as a specialist in failure analysis of metals.

He wrote the book *Understanding How Components Fail*, now in its third edition. The book was a best-seller for ASM, and grew out of ASM magazine articles and education seminars that Don developed. *Understanding How Components Fail* was one of the first publications to present a scientific, systematic approach to failure analysis.

Don received his ASM Fellow Award in 1970 and was a part of the Fellow Inaugural Convocation and Rededication of Metals Park that year. He was among 200 members in the very first class of Fellows.



Wulpi

Don’s citation as listed in the event program read:

Following his retirement in 1980 from International Harvester, where he had worked for 30 years, Don started his own metallurgical consulting business specializing in failure analysis. He devoted himself to teaching the principles of failure analysis at the ASM International headquarters, in Materials Park, Ohio, and at various companies throughout the United States. He served as an expert witness in court cases internationally, and held a patent for a tool for cold rolling crankshaft fillets.

Reference: J Fail. Anal. and Preven. (2016) 16: 940.



Workshop on Prevention of Failures during Manufacturing and Production (PFMAP-2017) at Madras Institute of Technology, Anna University, Chennai

A workshop on “Prevention of Failures during Manufacturing and Production”- PFMAP-2017 was organised during Feb. 3-4, 2017 jointly by SFA, Chennai Chapter and The Association of Production Engineers (TAPE) at Madras Institute of Technology (MIT), Chromepet, Chennai..

Dr.B.P.C.Rao, Chairman, PFMAP-2017, Vice President, SFA, and Head, NDE Division, IGCAR welcomed the gathering and briefed the participants on the role of failure analysis in engineering industry, the activities of SFA, the genesis of this workshop, and gave an overview of the technical programme. Prof.A Kesavan, Head, Department of Production Technology, MIT addressed the participants and highlighted the efforts taken by TAPE and MIT in organizing various training programmes for the benefit of students and faculties. Prof.A.Rajadurai, Dean, MIT delivered the inaugural address emphasizing the role of failure analysis in providing feedback to manufacturing industries and improving the quality of products. Shri.C.N.Venkiteswaran, IGCAR and Convener, PFMAP-2017 presented the vote of thanks on behalf of SFA, IGCAR thanking MIT, all the invited speakers, Prof. A. Siddharthan, MIT, Dr. P. Ganesh, MIT and the sponsors viz. ABS Instruments Pvt. Ltd., AMIL Ltd., IR Technology Services Pvt. Ltd. and Trotix Robots.

The technical talks were delivered by experts drawn from industry, research, and academia. On February 3rd, talks were delivered by Shri R. Suresh Kumar, IGCAR, Prof.Siddharthan, MIT, Dr.S.V.S.Narayanamurty, VSSC, Thiruvananthapuram, Smt. Swati Biswas, GTRE, Bangalore and Dr.P.Parameswaran, IGCAR. The lectures were followed by a practical session on metallography. Shri.R.Thirumurugesan, IGCAR and Shri.P.Sukumar, IGCAR (Retd.) practically demonstrated how metallography and portable in-situ metallography were performed.

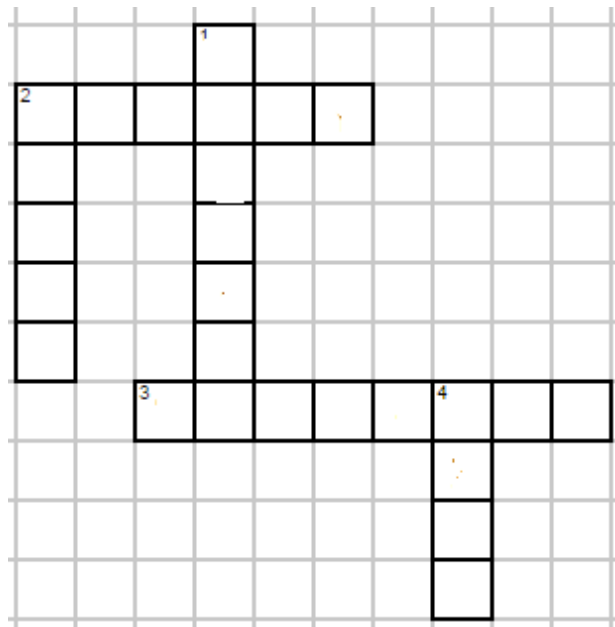
On the 2nd day of the workshop, talks were delivered by Dr. T. Jayakumar, NIT, Warangal, Dr.Shaju K.Albert, IGCAR, Prof.Raghu Prakash, IIT,Madras and Prof.Duraiselvam, NIT, Tiruchirappalli, Shri K.V.K. Deshpande, NFC, Hyderabad, Dr.Anish Kumar, IGCAR and Dr.V.Karthik, IGCAR. Around 65 delegates from industry, academia, and research attended this workshop. A very good interaction of the participants with the speakers through questions and discussions was observed. The participants were benefitted from the talks as evident from the feedback and appreciations received during the feedback session chaired by Dr.T.Jayakumar, Past-President, SFA.





Practical session during PFMAP-2017 at MIT Campus, Anna Univ., Chennai

Cross word puzzle



Across

2 Standard test of impact

3 Microconstituent

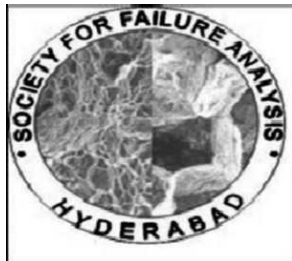
Down

1 Cause for embrittlement

2 High temperature failure mode

4 Also a test for impact





Society for Failure Analysis

Application Form

Society for Failure Analysis

C/O Centre for Military Airworthiness & certification, RCMA (Materials)
Hyderabad 500 058

Phone: 040-24340750; 24348377;

Fax : 040-24341827

E-mail: rdrcma.mat@cemilac.drdo.in

Affix a passport size photograph

Please ✓ applicable

member

☐

Life Member

☐

1. Name in Block Letters

First

Middle

Last

2. Date of birth

3. Father's Name/ Husband's Name

4. Present Occupation /Designation and office address:

Phone:

Mo

Fa

En

5. Academic & Professional

6. Home address:

Phone:

Mobile:

Fax:

E-mail

6. Address for correspondence:

☐☐

7. Professional Experience:

8. Endorsement by SFA Member

Name	Membership No.	Signature

9. Primary Field of Interest: (please mark 1,2,3 in the in order of preference)

Strategic ☐	Power ☐	Foundry ☐	Welding ☐	Heavy industry ☐	transport ☐
Design & Failures ☐	Quality control ☐	Petrochemical ☐	Consultancy / services ☐	Materials and manufacturing ☐	Education ☐

10. Name of the Chapter you intend to be attached

(Please refer to Chapters' list)

11. Subscription details:

Payment should be made by cheque / DD favoring "Society for Failure Analysis", payable at Hyderabad. Outstation cheques not accepted.

Amount Rs. Cheque / D.D. No Dated

Bank Name Branch

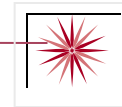
Category	Amount Payable		
	Admission Fee (One time)	Yearly Subscription	Total on joining
Member	----	Rs.200 (annual)	Rs.200/-
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12 Declaration by the applicant

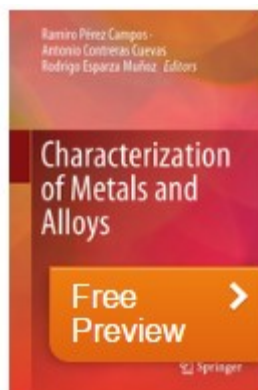
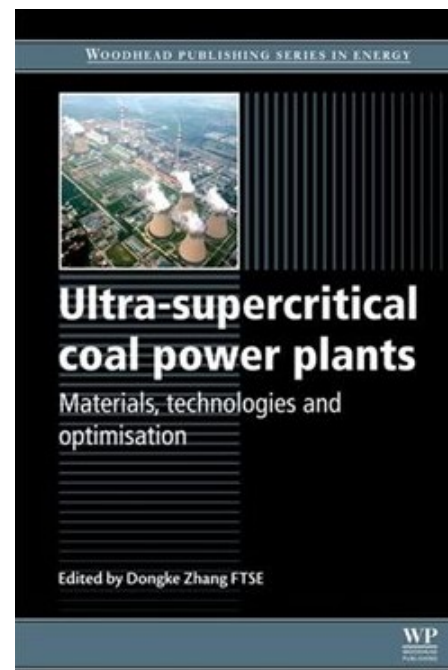
If elected, I agree to accept to pay the prescribed yearly subscription, to abide by the rules of the Society and to promote its aims and objects.

Signature of the Applicant

13.	Office Use Only				
	Membership No.		Date of Enrolment		Chapter
	Amount Paid (Rs)		Receipt No. / Date		



The need for more efficient, cleaner and productive coal power plants means that new materials and designs must be developed that will operate at much higher temperatures, especially in countries where coal will remain one of the major energy resources in the future. The editor and contributors provide a comprehensive reference on the developments, materials, design and operation of ultra-supercritical power plants. Following a chapter introducing advanced and ultra-supercritical coal power plants, part one goes on to explore the operating environments, materials and engineering of ultra-supercritical coal power plants. Chapters discuss the impacts of steam conditions on plant materials and operation, fuel considerations and burner design, and materials



Characterization of Metals and Alloys

Editors: **Pérez Campos**, Ramiro, **Contreras Cuevas**, Antonio, **Esparza Muñoz**, Rodrigo (Eds.)

Focuses on a range of techniques resulting in preparation of metals and alloys that are amorphous, crystalline, powder, coating, fiber, or thin film

Describes structural characterization techniques including scanning electron microscopy, X-ray diffraction, transmission electron microscopy, Raman spectroscopy, optical microscopy, and Fourier transform infrared spectroscopy

Includes theoretical models and illustrations of characterization properties - both structural and chemical.





Events in the pipeline

ICMCTF'17 - International Conference On Metallurgical Coatings & Thin Films: 24-28 Apr 2017

<http://www2.avs.org/conferences/icmctf/>

ICMAT — 9th International Conference on Materials for Advanced Technologies: 18-23 June, 2017

<http://icmat2017.mrs.org.sg/>

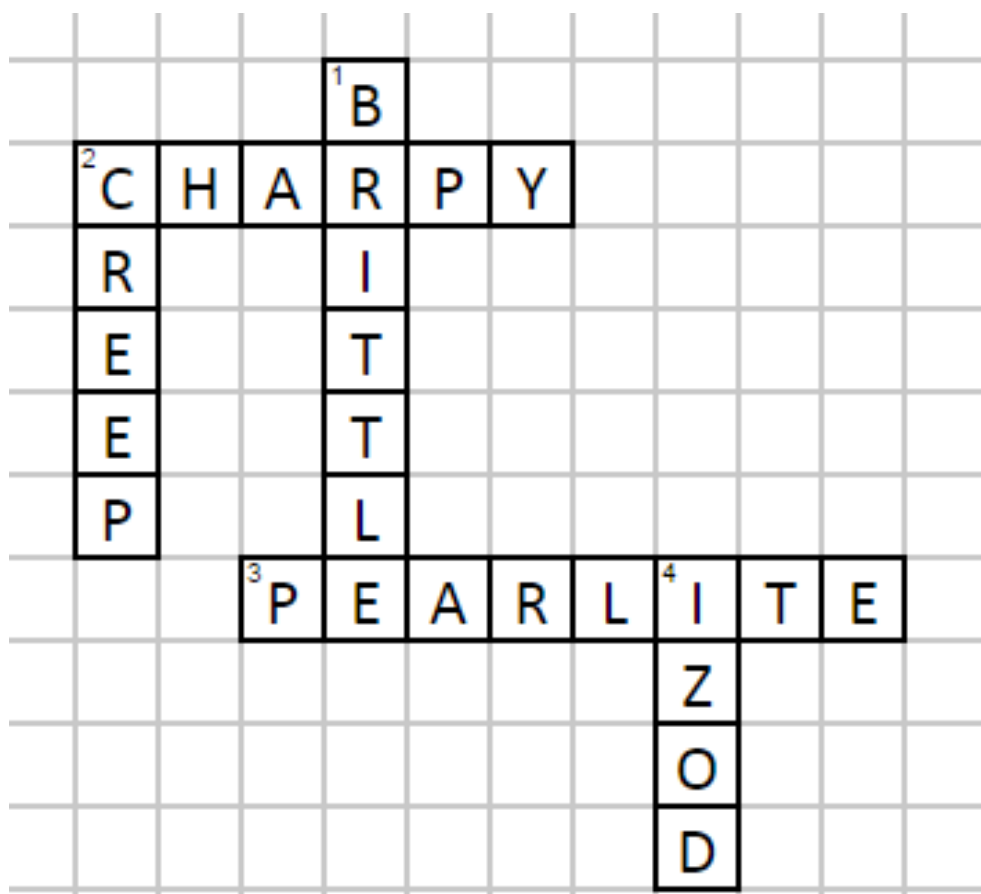
Fatigue 2017: 03 Jul 2017 - 05 Jul 2017

<http://www.fatigue2017.com/>

2nd International Conference on Engineering Design and Analysis (ICEDA 2017)- 13-15, oct 2017:

<http://www.iceda.org/index.html>

.Answers to Cross word





Forth coming SFA events* for the current year (2017-2018)

- 1) National conference on Engineering Failure Analysis –2017
- 2) Half day theme meeting on Engineering Failure Analysis-
March, 2017

Latest articles in J Failure Analysis and Prevention:

<http://link.springer.com/search?query=engineering+failure+analysis%2C+2015+articles&facet-discipline=%22Materials%22>

Latest articles in Engineering Failure analysis:

<http://www.journals.elsevier.com/engineering-failure-analysis/>

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