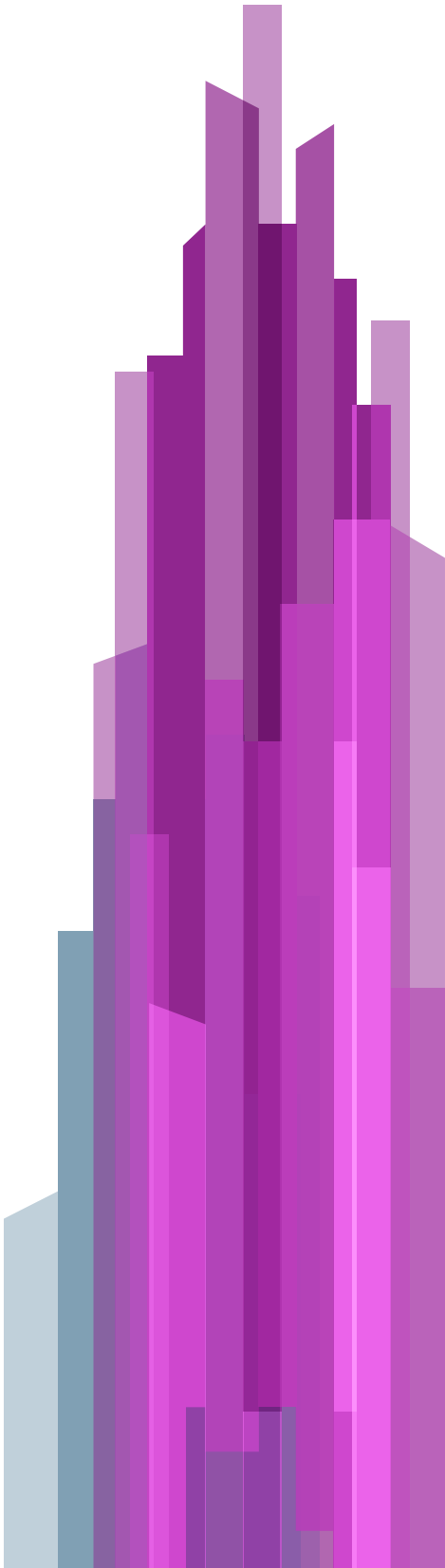
JÖNKÖPING UNIVERSITY

PFAM XXVII

PROCESSING AND FABRICATION OF ADVANCED MATERIALS

Twenty-seventh International Conference
27–29 May 2019, Jönköping, Sweden

// CONFERENCE PROGRAM



Welcome to Processing and Fabrication of Advanced Materials-XXVII

Welcome to the Twenty-Seventh International Conference on Processing and Fabrication of Advanced Materials (PFAM-XXVII), held at Jönköping National University, Jönköping, SWEDEN, 27–29 May 2019. The Jönköping University (Jönköping, Sweden) was the prime sponsor of this conference, spread over three days. This conference is the twenty-seventh in a series, bringing together engineers, technologists, and researchers from industry, universities and national/government laboratories, working on aspects related and relevant to the processing, fabrication, characterization and evaluation of traditional, advanced and emerging materials for potential use in a wide spectrum of both performance-critical and non-performance critical applications, to present and discuss their research findings, observations and inferences. This conference was essentially held in honor of Dr. Manoj Gupta, of the National University of Singapore (Singapore), in response to his innumerable novel, innovative and inspiring contributions to the domains of Materials Science and Engineering and Manufacturing Processes and importantly to the published literature.

All the necessary information for the conference participation can be found in this programme pamphlet

Jönköping 2019-05-09

The organisers

Dr. Anders E. W. Jarfors
Dr. T. S. Srivatsan
Dr. Caterina Zanella
Dr. Attila Diószegi

Dr Manoj Gupta

Dr Manoj Gupta was a former Head of Materials Division of the Mechanical Engineering Department and Director designate of Materials Science and Engineering Initiative at NUS, Singapore. He did his Ph.D. from University of California, Irvine, USA (1992), and postdoctoral research at University of Alberta, Canada (1992). In August 2017 he was highlighted among Top 1% Scientist of the World Position by The Universal Scientific Education and Research Network and among 2.5% among scientists as per ResearchGate. To his credit are: (i) Disintegrated Melt Deposition technique and (ii) Hybrid Microwave Sintering technique, an energy efficient solid-state processing method to synthesize alloys/micro/nano-composites. He has published over 510 peer reviewed journal papers and owns two US patents. His current h-index is 60, RG index is > 46 and citations are greater than 23500. He has also co-authored six books, published by John Wiley, Springer and MRF – USA. He is Editor-in-chief/Editor of twelve international peer reviewed journals. In 2018 he was announced World Academy Championship Winner in the area of Biomedical Sciences by International Agency for Standards and Ratings. A multiple award winner, he actively collaborate/visit Japan, France, Saudi Arabia, Qatar, China, USA and India as a visiting researcher, professor and chair professor.

JÖNKÖPING UNIVERSITY

Jönköping University is a professional-oriented university. It is one of three Swedish private, non-profit institutions of higher education with the right to award doctorates. JU conforms to national degree regulations and quality requirements.

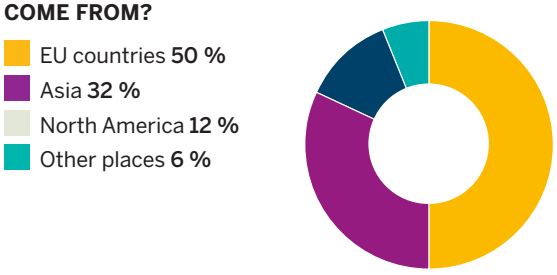
The university is organised as a non-profit corporate group owned by Jönköping University Foundation with six subsidiaries: the School of Health and Welfare, the School of Education and Communication, Jönköping International Business School, the School of Engineering, University Services and Jönköping University Enterprise.

Jönköping University has 12,600 students, of which 2,300 are international students. The University offers 80 programmes and specialisations on Bachelor's, Master's and Doctorate level. Jönköping University is entitled to issue doctoral degrees in the disciplinary research domain of humanities and social sciences.

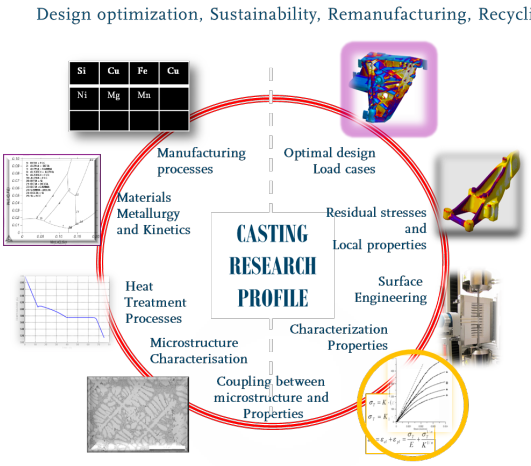
Within technology, the university issues licentiate and doctoral degrees in the field of Industrial Product Development.

The largest research group is that within Materials and Manufacturing Within technology, the university issues licentiate and doctoral degrees in the field of Industrial Product Development.

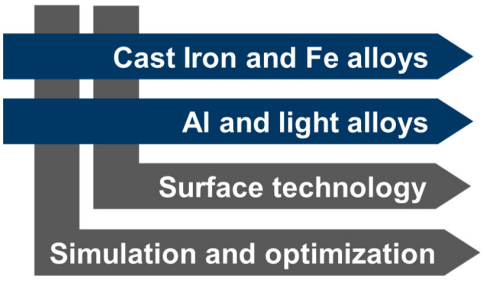
WHERE DO OUR INTERNATIONAL STUDENTS COME FROM?



DEPARTMENT OF MATERIALS AND MANUFACTURING



The research at Department of Materials and Manufacturing has had the focus and vision to facilitate simulation of material behaviour through the manufacturing process to component performance in use. In this is it essential to consider sustainability factors and recycling issues as this influences the material behaviour in the process, as well as component properties and then especially fatigue properties. To cater for this, the department has 4 different research topics, where the first topic is Cast Irons and Fe-Alloys including Foundry technology that primarily deals with the questions on how to cast and generate a sound component with a suitable microstructure in Cast Irons and Fe-Alloys. The next research area is Al and light alloys. This area is primarily focusing on high pressure die casting

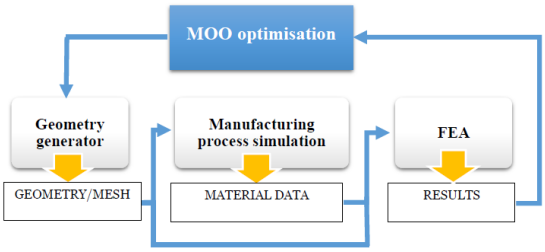


Research division at Jönköping University, School of Engineering, Department of Materials and Manufacturing

and rheocasting with both focus on the process development and the ally development. The third area is Surface Technology that focus on both surface coating and the protection of primarily cast components including plating and anodising. The main skill is electro-chemistry applied to both protection and con corrosion.

In all these areas materials characterization and properties modelling that treats the translation of microstructure into thermo-physical and mechanical properties of the component is a critical element. Putting it all to work is made in the Simulation and optimization research area. One area of focus is to develop methodology to package the knowledge into principles where the microstructure and properties can be predicted in the part through process simulation and lifted over to design tools to predict the behaviour of the component in use which is the interface with the design and product development. Critical in this is that the casting process generates an inhomogeneous microstructure resulting in local variation in mechanical properties of the component.

For some time, it has been possible to simulate the full closed chain from the molten material to the component in use for static properties and loads such as yield strength and Young's modulus. During the last few years the first steps towards dynamic loading were taken with the enabling of high temperature performance modelling to facilitate in process residual stress modelling and creep behaviour. Similarly, the influence of recycled materials and defect formation in aluminium was investigated with emphasis on oxide and iron bearing intermetallics and their impact on material properties. With residual stress and defects modelling, the first steps towards effective modelling of fatigue were taken and thus also life-span prediction leading to the possibility to incorporate effective warranty cost management and remanufacturing aspect in to the design process through process simulation and real intrinsic knowledge intensive product realization is thus realisable to a new level. In this effort optimization is a critical skill with new FEM methods and optimization methods are developed with cut elements and topological optimization being focus areas.



Integration between process simulation and the product design optimisation

LAB TOUR

There will be possibility for a short lab tour and a stroll between the end of the conference programme on Tuesday 28 May and before the conference dinner. To visit the labs it is a 20 minute walk to the casting facilities so the return will be just before the dinner.

Conference Programme

Monday, May 27th		
13:00–13:30	**Registration**	
13:30–14:00	**Welcome and opening**	
14:00–17:00	**Session 1: plenary session**	
14:00–14:40	4	**Manoj Gupta** Unravelling the Potential of Magnesium in Engineering and Biomedical Applications
14:40–15:20	6	**Dr. Srivatsan Tirumalai,** *Kondisetti Dheeraj and Anil Patnaik.* Conjoint Influence of Composition and Processing on Microstructure and Mechanical Response of High Performance Stainless Steel
15:20–15:40	Tea and Coffee Break	
15:40–16:20	67	**Per Nylen.** Advanced coatings by thermal spray processes
16:20–17:00	41	**Subodh Kumar.** Development of light alloys for aerospace and automotive applications
17:00–18:30	Welcome and mingle	

Tuesday, May 28th				
09:00–10:40	Session 2A: Manufacturing processes		Session 3: Mechanics and tribology of materials	
09:00–09:20	73	Nodir D. Turakhodjaev, Shirinkhon N. Turakhodjaeva and Jamaliddin S. Kamalov. The process of melting aluminum alloys to improve the quality of castings	63	Saleh Abdullah Al Woahibi, Abdul Samad Mohammed, Tahar Laoui, Abbas Saeed Hakeem and Fahe-emuddin Patel. Tribological performance of micro/nano WC-9%Co cemented carbide prepared by a spark plasma sintering technique
09:20–09:40	68	Anders Jarfors and Jakob Olofsson. A reassement of the Quality Index for aluminium castings	18	Srinivasan Murugan, Parande Guruaj, Kamaraj M and Gupta Manoj. Dry Sliding Wear Behaviour of Egg Shell Reinforced Mg-2.5Zn Magnesium Matrix Eco-Composite
09:40–10:00	**52**	Henrik Borgström. Optimisation of Furan Sand Moulding and Blacking Process	**7**	Umang Pawar, Anil Patnaik and Srivatsan Tirumalai. Influence of environment and nature of loading on residual strength of a high strength low alloy steel
10:00–10:20	**44**	Chen Yuan and Stuart Blackburn. Development and Evaluation of Alumina Ceramic System towards Investment Casting Reactive Alloy	12	Domen Šeruga, Marko Nagode and Jernej Klemenc. Measurement of stress-strain response during cyclic tests
10:20–10:40	1	Anders Jarfors, Jinchuan Zheng and Salem Seifeddine. The route to bring design and production together	**15**	Arvind Singh, S. Jayalakshmi, Xizhang Chen, Sergey Konovalov, S. Sankaranarayanan, Manoj Gupta and Srivatsan Tirumalai. Role of Nano-Size Reinforcements in Governing the Tribological Behavior of Magnesium Alloys
10:40–11:00	Tea and Coffee Break			
11:00–12:20	Session 2B: Manufacturing processes		Session 4: Coatings	
11:00–11:20	**48**	Daniel Wojtas, Krzysztof Wierzbanowski, Marcin Wroński, Krzysztof Sztwiertnia, Magdalena Bieda, Robert Chulist and Wacław Pachla. Mechanical properties, microstructure and texture of titanium grade 2 processed by hydrostatic extrusion	57	Kenji Amiya. Preparation of Ni-Mo-B amorphous coatings with high corrosion resistance by thermal spray method
11:20–11:40	**55**	Haizea González, Amaia Calleja, Roberto Polvorosa, Octavio Pereira and Luis Norberto López de Lacalle. Surface integrity in the machining of heat-resistant alloy blisks	**50**	Donya Ahmadkhaniha and Caterina Zanella. Heat treatment optimization of hard and protective nanocomposite NiP/SiC electrodeposited coatings
Tuesday, May 28th				

11:40–12:00	**45**	Anders Jarfors, Roland Stolt and Taishi Matsushita. Spatter control in Additive Manufacturing	**56**	Michele Fedel and Flavio Deflorian. Effect of synthesis conditions on the controlled growth of MgAl-LDH coatings: structural and functional properties
12:00–12:20	43	Ebad Bagherpour, Yan Huang and Zhongyun Fan. Microstructural investigation of the assessed high strength Al6082 self-piercing riveted joints	**49**	Daniel Wojtas, Krzysztof Wierzbanowski, Magdalena Bieda, Robert Chulist, Anna Jarzębska, Łukasz Maj, Krzysztof Sztwiertnia, Miroslaw Wrobel, Wacek Pachla and Faiz Muhaffel. Phase composition and microstructure of antibacterial coatings deposited on titanium fabricated by hydrostatic extrusion
12:30–14:00	Lunch Break			
14:00–15:20	**Session 2C: Manufacturing processes**		**Session 5: Magnesium**	
14:00-14:20	**14**	Lluís Pérez Caro, Eva-Lis Odenberger and Mats Oldenburg. Cold and hot forming procedures for alloy 718	**22**	Vyasaraj Manakari, Gururaj Parande, Abhishek Mangipudi, Somasundaram Prasadh, Raymond Wong, Beng Wah Chua and Manoj Gupta. Development of Multifunctional Mg-Li alloys
14:20–14:40	25	Sridhar Narayanaswamy, Zhiqian Zhang, Junyan Guo, Damodara Reddy, Sabeur Msolli, Zheng Zhang, Jisheng Pan, Boon Hee Tan and Qizhong Loi. Virtual Platform for Cold Spray Additive Manufacturing Process with an Integrated Multiphysics Multiscale Computational Model	**13**	Jernej Klemenc, Domen Šeruga and Marko Nagode. Plastic and total energy as the basis of durability prediction for magnesium alloy AZ31
14:40–15:00	70	Fazilatxon Turakhodjaeva. Methods to improve the mechanical properties of biomass	72	Kumud Burman, Aditya Gokhale, Sujeet Kumar Sinha and Jayant Jain. Effect of aging on mechanical and tribological properties of a Mg-8Gd-2Dy alloy
15:00–15:20	**5**	Li Lu, Linchun He and Chao Chen. Inorganic Solid Electrolyte for Solid-state Batteries	**31**	Rajaraman Muraliraja, Pandiyan Mohan Raj, Arunachalam Ramanathan and Pradeep Kumar Krishnan. synthesis, characterization and testing of Mg-SiC composite using different manufacturing process to achieve best properties
15:20–15:40	Tea and Coffee Break			
15:45–16:30	**Optional lab tour**			
19:00–23:00	**Conference dinner**			

*papers marked in bold are invited papers

Wednesday, May 29th				
09:00–10:40	Session 6A: Metallic composites		Session 7: High entropy alloys	
09:00–09:20	**16**	Roger Svenningsson and Ilja Belov. Experimental and Simulation Study of Mould Filling in Al MMC Gravity Casting	35	Young-Sang Na, Ka-Ram Lim and Yong-Hak Kim. Gas pressure molding of metallic glass sheet by employing rapid heating method
09:20–09:40	29	Ramanathan Arunachalam, Pradeep Kumar Krishnan, Majid Al-Maharbi and Rajaraman Muraliraja. Effect of Reinforcement Particle Size on the Properties of Aluminium Composites Produced by Squeeze Casting Process	**46**	Benjamin E. MacDonald, Zhiqiang Fu, Julia Ivanisenko, Horst Hahn Hahn and Enrique J. Lavernia. Influence of constituent element concentration on the mechanical behavior of solid solution CoCuFeMnNi high entropy alloys
09:40–10:00	32	Torgom Akopyan, Nikolay Belov and Nikolay Letyagin. New nanostructured metal matrix composites based on Al, with a high fraction of aluminides Al(Ca, La, Ni, Zr, Sc)	**36**	Ka-Ram Lim, Hyun-Jun Kwon, Jong-Woo Won and Young-Sang Na. Dual-phase high-entropy alloys for high-temperature structural applications
10:00–10:20	**19**	Olena Sukhova and Yuliya Syrovatko. Formation of metal matrix composites reinforced by AlCoCu particles	**10**	K.S. Tun, Manoj Gupta and Srivatsan Tirumalai. Processing, microstructure and mechanical characterization of MgAlLiZnCaCu high entropy alloy
10:20–10:40	21	Rahul Sethi, Sanjay Mohan, R. Arvind Singh, S. Jayalakshmi and Srivatsan Tirumalai. Synthesis and characterization of Fe-Mo-BaF2 self-lubricating composites prepared by powder metallurgy	**17**	Khin Sandar Tun, Tirumalai Srivatsan and Manoj Gupta. Microstructure and Mechanical Property Enhancement in Magnesium Using Ball-milled High Entropy Alloy Reinforcement
10:40–11:00	Tea and Coffee Break			
11:00–12:20	Session 6B: Metallic composites		Session 8: Corrosion	
11:00–11:20	53	Andrzej Baczmanski, Przemyslaw Kot, Elzbieta Gadalinska, Sebastian Wronski, Marcin Wroński, Mirosław Wróbel, Christian Scheffzuek, Gizo Bokuchava and Krzysztof Wierzbanowski. Neutron measurements of stresses in Al/SiCp composite during mechanical loading	**20**	Olena Sukhova, Vladimir Polonsky, Katerina Ustinova and Marina Berun. Corrosion of quasicrystalline Al–Cu–Fe and Al–Ni–Fe alloys in acidic solutions
11:20–11:40	**62**	Satyakam Kar, Jan Bohlen and Hajo Dieringa. Effect of AlN nanoparticles added by intensive melt shearing on the microstructure and mechanical properties of an extruded AM60 magnesium alloy nanocomposite	**23**	Gururaj Parande, Vyasaraj Manakari, Somasundaram Prasadh, Raymond Wong and Manoj Gupta. Mechanical, corrosion and cytotoxicity response of novel lightweight magnesium-based alloy nanocomposites

11:40–12:00	9	Seetharaman Sankaranarayanan, Manoj Gupta and Srivatsan Tirumalai. Conjoint influence of reinforcement and processing on microstructural development and mechanical response of magnesium-based composites	47	Baiwei Zhu and Caterina Zanella. Effect of Fe-intermetallics on surface hardness and corrosion resistance of anodised Al-Si produced by rheocasting
12:00–12:20	8	Seetharaman Sankaranarayanan, Manoj Gupta and Srivatsan Tirumalai. On the influence of processing on microstructure and mechanical response of magnesium-based nanocomposites	69	Esmaeil Sadeghi, Venkataramanan Mohandass and Paria Karimi Effect of shot peening on high temperature corrosion behaviour of Alloy 718 manufactured by EB-PBF technique
12:30–14:00	Lunch Break			
14:00–15:00	**Session 6C: Metallic composites**		**Session 9: Polymers**	
14:00–14:20	42	Milli Suchita Kujur, Vyasaraj Manakari, Gururaj Parande, Somasundaram Prasadh, Raymond Wong, Ashis Mallick and Manoj Gupta. Rare-earth Oxide Reinforced Magnesium Nanocomposites: A Potential Candidate for Automotive and Biodegradable Implant Applications	71	Upendra Kulshrestha, Subrata Bandhu Ghosh and Niti Nipun Sharma. Investigation of mechanical behavior of selective Carbon Black Nano-particulate Reinforced Rubber composites
14:20–14:40	26	Sravya Tekumalla, Ayush Rai, Gururaj Parande, Vyasaraj Manakari and Manoj Gupta. Synergistic effects of alloying elements and nano-reinforcement on the mechanical and ignition response of magnesium	65	Abdul Samad Mohammed, Annas Bin Ali and Nesar Merah. Tribological Performance of Organoclay reinforced UHMWPE Nanocompoistes under Water lubricated conditions
14:40–15:00	**Closing remarks**			
15:00–15:20	Tea and Coffee Break			

*papers marked in bold are invited papers

GENERAL INFORMATION AND INSTRUCTIONS TO SPEAKERS

The conference venue

The conference venue is marked on the map at the end of this programme pamphlet. The address and contact to the hotel is:

Elite Stora Hotellet
Hotellplan 3
553 20 Jönköping
Phone: +46 (0)36-10 00 00

Registration

Participants have preregistered but on arrival at the venue please register at the conference registration desk to get the materials for the conference.

Participants

Please be on time for the presentations. If you have special dietary requests these should have been registered online when the registration was made. You are welcome to double check these. Special requests and allergy adapted food will be marked on buffet style serving. On dinner please approach the serving staff to let them know your dietary needs

Speakers

Speakers should be on site 15 minutes before their session starts to upload the presentations on the computer in the room. Support staff will be on site to aid you in this process. Plan your talks to allow at least 5 minutes discussion and questions

Session Chairmen

Chairmen should be on site at least 15 minutes before the start of the session. Check that all presenters are on site. The task is to keep the timing of each presentation. Give signal when 10 minutes and 5 minutes remains. If a presenter should be missing do not shift the presentation but keep the schedule strictly to allow the participants to plan and schedule their participation

Coffee and coffee breaks

The coffee and coffee breaks will be served at the restaurant on the first flor at The Trottoir restaurant

Conference dinner

The conference dinner will also be served at the hotel.

BEST PAPER

There will be a best paper award for which the paper will be selected and the winner will have a publication in Metals/Technologies special issue free of charge

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Special Issue:
PROCESSING AND FABRICATION OF ADVANCED MATERIALS

Guest Editors: Prof. Anders E. W. Jarfors, Professor Attila Dioszegi, and Associate Professor Caterina Zanella, Jönköping University

E-mail: anders.jarfors@ju.se

The current special issue focus on recent advances made in the field of materials and their manufacturing. The primary purpose this inter-disciplinary development on all aspects related to the processing and fabrication of advanced materials focusing on metals. This special issue aims to provide a volume of the latest advances on aspects related and relevant to materials processing and fabrication from both a research perspective as well as an engineering and industrial and application perspective in the fields of :

- **Materials**
  - Metals and Metal-Matrix Composites
  - Surface Coatings
  - Magnetic Materials
  - Metallic Glasses
  - Materials for wind-power systems
  - Intermetallic(s)
  - Intermetallic-Matrix Composites
  - Nano Materials and Nanocomposites
  - Functional Materials
- **Manufacturing Technologies**
  - Additive manufacturing
  - Casting
  - Microwave processing of materials
  - Powder metallurgy
  - Machining
- **Materials Simulations**
  - Process and microstructure relations
  - Process and defect formation
  - Materials properties predictions
  - Component behaviour

Where possible, presentations on the above fields should relate to applications in one of the following seven industry focus areas:

- Aerospace
- Electronics and Communications
- Automotive
- Energy Storage/Harvesting
- Applications and Utilities
- Marine
- Sport Goods
- Biomedical and Healthcare
- Handheld tools and devices
- Heavy Equipment, Machinery & Goods
- Failure Analysis: Implications and Applications

Keywords: Material Characterization, Mechanical Properties, Mechanical Behavior of Materials, Microstructure, Materials Processing, Advanced Materials, Component behavior, Casting, Powder metallurgy, sheet metal forming

JÖNKÖPING THE CITY AND WHAT TO DO!

Not many cities have a setting as Jönköping in southern Sweden. Lake Vättern, the second largest lake in Sweden. The nature of the region was captured by the artist John Bauer, and sprinkled with a touch of magic with his illustrations of trolls and forest fairies. The top 10 Jönköping sites are listed here for your convenience

1. Matchstick Museum

The safety match was invented in Jönköping and turned the city into a match-producing capital from 1845 to 1970. The exhibitions recount the story of figures like the Lundström brothers driving manufacturing to new heights and Ivar Kreuger the matchstick king

2. Habo Church

The Habo Church has the dimensions of a cathedral but is made completely from wood. The church dates to 1680 and has been kept in mint condition since 1723 It is located a 15 minutes' drive north of the city, on the west shore of Vättern,

3. Jönköping Stadspark

West of the city centre, the Stadspark is a green city district. The main attractions are an arboretum planted 1900 and the Jönköping's open-air museum with ten historic buildings. There is also a bird museum with a collection of 1450 birds from 330 species.

4. Sofiakyrkan

The soaring spire is one of the city's main landmarks and held high with its Gothic Revival design. On the carved wooden altar is a crucifix by the artist Carl Johan Dyfverman, and there's a beautiful Italian Baroque painting of Supper at Emmaus purchased in Rome in the 1600s.

5. Jönköpings Läns Museum

This small museum charts the culture of Jönköping County, and is filled with the art and illustrations of John Bauer's fantastical illustrations of magic trolls.

6. Radiomuseet

This museum maps more than a century of radio and communication technology. It is housed in a industrial brick building near the station. The collection was started by a 20th-century radio enthusiast, Erik Karlson who assembled his first wireless in 1923.

7. Rosenlunds Rosarium

Near the lakeshore a few steps from the city's beach (Vätterstrand) a rosegarden on the grounds of a mansion from 1788, with more than 500 varieties of roses. It's a must-do from May to July, even more so if you're botanically minded.

8. Kristine Kyrka

This 17th century sandstone Baroque style church is a beauty. Inside you can find an oil painting of the crucifixion by the 18th-century artist Edvard Orm, while the altar was painted around the same time by Frenchman PC Cazes.

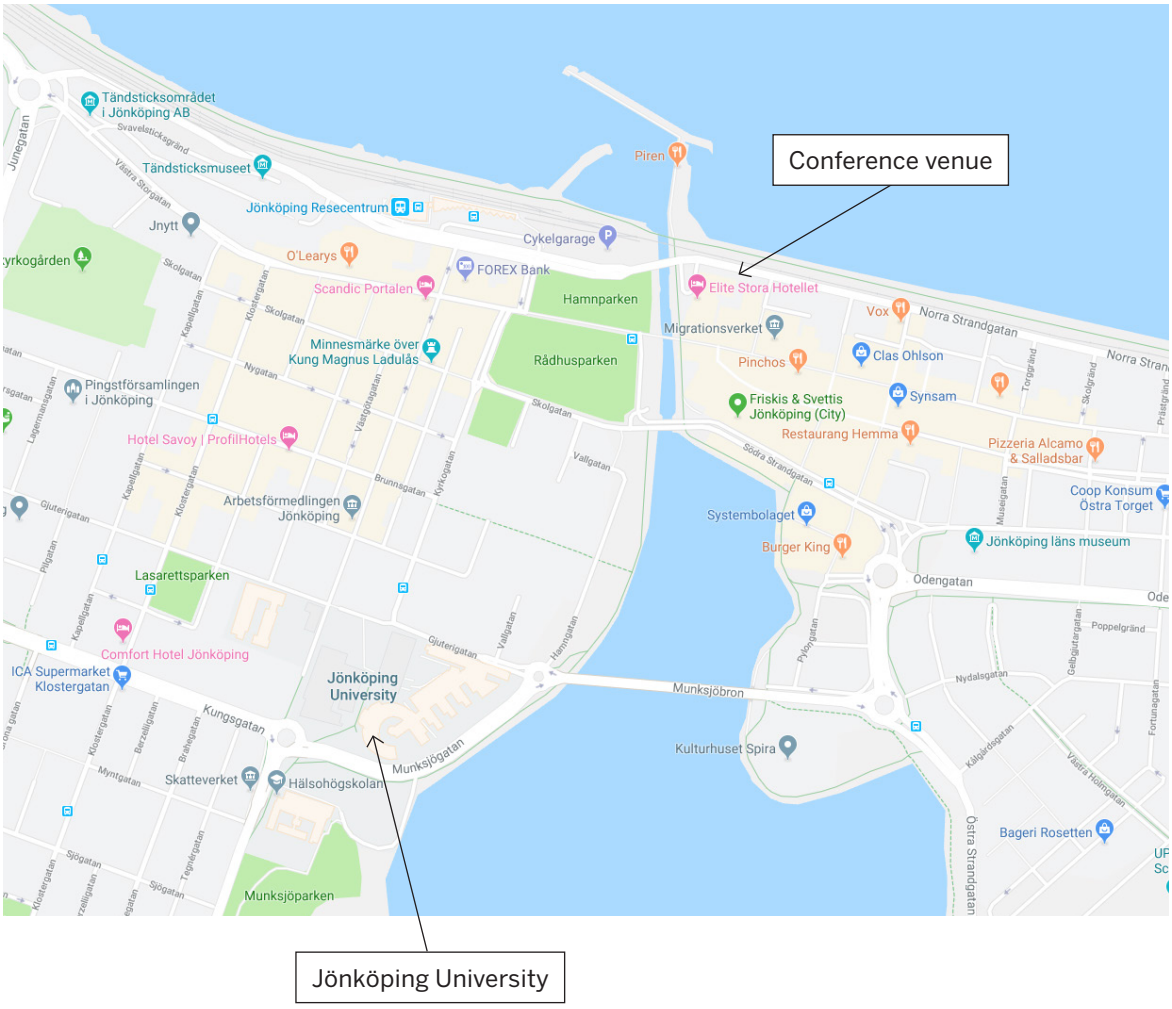
9. Husqvarna Industrial Museum

The manufacturing giant Husqvarna has had its fingers in many pies down over the last 400 years. What began as a weapons manufacturer branched out into sewing machines, bicycles, motorcycles and is probably now best known for its power tools and robotic lawnmowers.

10. Vätterstranden

When you're confronted by the vastness of Lake Vättern you could truly believe that you are close to the sea. On clear summer days this is a godsend. It stretches from the centre and its jetty and east with cafes and restaurants by the beach, but you're also close to all the shops and amenities if you need anything.

More attractions at:
www.thecrazytourist.com/15-best-things-jonkoping-sweden


Conference venue
Jönköping University
Tändsticksområdet i Jönköping AB
Tändsticksmuseet
Jönköping Resecentrum
Jnytt
O'Learys
Scandic Portalen
FOREX Bank
Cykelgarage
Piren
Elite Stora Hotellet
Hamnparken
Rådhusparken
Migrationsverket
Vox
Norra Strandgatan
Pinchos
Clas Ohlson
Synsam
Friskis & Svettis Jönköping (City)
Restaurang Hemma
Pizzeria Alcamo & Salladsbar
Coop Konsum Östra Torget
Systembolaget
Burger King
Jönköping läns museum
Odengatan
Minnesmärke över Kung Magnus Ladulås
Pingstförsamlingen i Jönköping
Hotel Savoy | ProfilHotels
Arbetsförmedlingen Jönköping
Lasarettsparken
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Vallgatan
Södra Strandgatan
Östra Strandgatan
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