News you can use

AGREEMENTS SIGNED BETWEEN INDIA & RWANDA
Dear Doyens and Members of the Indian Leather Fraternity; Colleagues from CSIR; Mentors and Teachers, Colleagues and Friends! It gives us great pleasure in sending you our August 2018 edition of The LEATHER POST.

CSIR-CLRI congratulates Shri M Mohammed Hashim, Chairman, KH Group, as the Industry through the Council for Leather Exports honoured the doyen of the leather Industry with a “Lifetime Achievement Award”. We rejoice the appointment of Dr T Ramasami with the Nayudamma Abdul Wahid Chair Professorship at the Department of Leather Technology, Anna University. We also heartily congratulate CEMCOT for their tenth anniversary celebrations.

Our co-operation with Rwanda includes creation of a roadmap for the Leather value chain in Rwanda and this is indeed a feather in our cap.

Our Jigyasa initiative has reached the students in Coimbatore and the students are just loving “Science”.

The articles on Flame retardant coatings and Total CAD solutions for Footwear will hopefully interest you.

I wish to thank you all for your unstinted support and kind co-operation at all times,

We will strive to make this magazine informative and interesting and welcome your feedback for improvement.
Dr T Ramasami, Former Secretary, Ministry of Science and Technology, Former Director General, Council for Scientific and Industrial Research and Former Director, CSIR-CLRI has taken charge as First Professor of Nayudamma Abdul Wahid Chair Professorship at the Department of Leather Technology, Anna University from 2nd July 2018.

Nayudamma Abdul Wahid Chair Professorship at the Department of Leather Technology, Anna University has been instituted by Indian Finished Leather Manufactures & Exporters Association (IFLMEA). This Chair Professorship has been created to facilitate pedagogy teaching and mentoring research activities in Leather Science & Technology.

Dr T Ramasami, a distinguished researcher, is the recipient of prestigious Shanti Swarup Bhatnagar Award and also Civilian Honours, the Padma Shri and the Padma Bhushan and other Academic Fellowships. He was instrumental in elevating the Academy-Research-Industry trinity partnership to greater heights. His presence would guide the department, in grooming the budding technologists to transform the Indian as well as global leather sector to a sustainable pathway.
CSIR-Central Leather Research Institute signed a MoU on Collaboration in the Areas of Leather and Allied Sectors with National Industrial Research and Development Agency (NIRDA), Rwanda by “Dr. B. Chandrasekaran, Director, CSIR- CLRI and Ms. Kampeta Sayinzoga, Director General, NIRDA” in the presence of honorable Prime Minister and President, CSIR, Shri. Narendra Modi and His Excellency. Paul Kagame, President of the Republic of Rwanda on 23 July 2018.

This is organized as part of the State Visit of Prime Minister to Rwanda, Uganda and South Africa (July 23-27, 2018) during this time India and Rwanda signed eight agreements on 23 July 2018 in an effort to bolster bilateral cooperation between the two countries.

The purpose of this MoU is for CSIR-CLRI extending cooperation to NIRDA in the following avenues:

- Preparation of Detailed Project Report (DPR) for the creation of a roadmap for the Leather value chain in Rwanda
- Supporting NIRDA towards fulfilling the industrial requirements for a Leather park in Bugesera, Rwanda
- Establishment of industrial hands-on training/testing/R&D center for leather and leather products
- Establishing a comprehensive skill development programme for private operators in leather and leather products value chain
- Transfer of Technologies in leather and allied areas
SCIENTIST – STUDENT INTERACTION PROGRAM AT KV-AFS, SULUR

A JIGYASA event – “Scientist-Student Interaction Program” was organized by CSIR-CLRI between 7th August 2018 and 9th August 2018 at KV-AFS, Sulur (Coimbatore). As many as 400 students from Class-XI and Class-XII stream from KV-Sulur, KV-Coimbatore, KV-Aruvankadu and KV-Wellington participated in the program.

On 7th August 2018 the program was inaugurated by Dr. B. Chandrasekaran, Director, CSIR-CLRI in the presence of the Guest of Honour Shri. C. Mani, Deputy Commissioner, KVS, Chennai. Mr. V. Meganathan, Principal, KV-AFS, Sulur and Mr. M. Arunachalam, Principal In-charge, KV-Coimbatore graced the occasion.

As a scientist mixed two organic compounds in a test tube in front of a group of school students, there were gasps of surprise as the colourless liquids turned into a white solid right in front of their eyes.

The students were from five Kendriya Vidyalaya (KV) schools in Coimbatore and Ooty, who had come to the Kendriya Vidyalaya Air Force Station at Sulur here to attend this student-scientist interaction, held as part of Jigyasa, a joint initiative of Kendriya Vidyalaya Sangathan (KVS) and the Council of Scientific and Industrial Research (CSIR).

Ten scientists from CSIR-Central Leather Research Institute (CLRI) in Chennai conducted seven experiments in physics, chemistry, biology, engineering and leather technology for the benefit of about 400 students from KV schools in Coimbatore, Sulur, Wellington, Ooty and Aruvankadu.

“While we try to bring advanced science to schools, we make it simple so that students can appreciate it. But, we take care not to dilute the content,” said a scientist. “We conducted an experiment on supramolecular gels, which is advanced chemistry. Earlier it would have been unimaginable to conduct such an experiment in schools.”

Deputy commissioner of KVS, Mr C Mani said the programme helped to take pure science to students. “While many students aspire to become doctors and engineers, there is a shortage of people to carry out research and development. Such programmes will help develop an interest among students to learn pure science,” he said.
Students, who attended the programme, said though the concepts were complicated, they found the experiments novel and interesting. “The programme made us realize that there was much more to explore in pure science in terms of a career,” said N Navya, a Class XI student from Coimbatore.

The two-day programme, inaugurated by Dr B Chandrasekaran, Director of CSIR-CLRI, concluded on 9th August 2018. V Meganathan, principal of KV, Air Force Station, Sulur, and P Arunachalam, principal (in-charge) of KV Coimbatore, facilitated the event. KVS and CSIR had signed a MoU in July 2017 to conduct student-scientist interactions, site visits to CSIR institutions and teacher training programmes.
National Workshop on Nuclear Magnetic Resonance (NMR) Spectroscopy was held at B. M. Das Hall, CSIR-CLRI, Chennai during 3-5th August 2018. The workshop was conducted in association with National Magnetic Resonance Society (NMRS), India and in commensurate with silver jubilee year of NMRS which falls this year.

A total number of 55 participants, out of 130 who had applied from the length and breadth of various parts of the country were selected. The 55 participants were exposed to a wide range of topics in the field of magnetic resonance through lectures by eminent scientists and actual demonstrations on the CLRI’s instruments at NMR facility, Inorganic and Physical Chemistry Laboratory (IPCL).

The first day of workshop started with Inaugural function and Dr. J. Raghava Rao, Head, IPCL welcomed the participants and gave a brief account of the hierarchical evolution of NMR in CSIR-CLRI. This was followed by the presidential address by Dr. B. Chandrasekaran, Director, CSIR-CLRI, who outlined the developments in CLRI NMR. Later, Prof. N. Chandrakumar, IIT, Chennai delivered his felicitation address on NMR establishment in CLRI and his association with the laboratory. The Inaugural function ended with an address by Prof. S. Subramanian, President, NMRS who spoke about the significance of NMR workshop, which is conducted as a part of silver jubilee of NMRS followed by the vote of thanks by Dr. Nitin P Lobo.
For all three days of NMR workshop, the 13 invited lectures by 12 eminent NMR scientists and onsite demonstrations have benefitted the participants in enriching their knowledge. All the participants got an adequate exposure to the basic principles, methodologies and various chemical and biochemical applications of magnetic resonance spectroscopy and imaging. The first two days of the workshop, the participants were given onsite demos on the NMR and EPR equipment.

The valedictory function was presided by Prof. S. Subramanian, President-NMRS accompanied by Prof. J. Subramanian, EPR expert and Dr. B. V. N. Phani Kumar, Convener-NMR workshop. The Convener welcomed the gathering and gave the proceedings of workshop, which would excite a number of young participants to take NMR and EPR based research in various academic and research pursuits. The concluding remarks by Prof. S. Subramanian revealed the success of the NMR workshop in disseminating the NMR knowledge to the researchers participated. The motivational speech by Prof. J. Subramanian encouraged the participants for their advanced career. Later, participation certificates were distributed followed by the feedback from the participants.

Finally, Dr. S. Easwaramoorthi proposed vote of thanks and the event concluded with the National anthem.
The current interest of environmental and safety issues is concerning with the applications of flame retardant coatings in the area of clothing, buildings, aerospace and marine. One of the ways in improving the flame retardancy is by using polymers such as epoxy, urethane and acrylates as coating substance. Flame retardants for instance, gaseous or solid, will reduce the speed of heating, consequently lowering the flaming velocity, burn increase, and smoke production throughout the decomposing conditions. They are vitally important to withstand against elevated temperatures by thermally decomposing into carbonaceous shielding layers, thereby obstructs the movement of oxygen to the flaming region of the polymer materials. There is a necessity to include various constituents during the formulations in order to reflect the tolerable stages of flame retardancy. Many flame retardants have been developed to improve their flame retardancy.

1. TRADITIONAL COATING
A traditional technique of preparing flame-retardant polymers is to blend flame-retardant additives with polymeric materials. Polymeric additives are preferred over conventional non-polymeric additives due to their better resistance to extraction, migration, volatile loss and the permanent availability of flame retardancy. In addition to the methods of preparing flame-retardant organic polymers, the development of novel flame-retardant compounds is a matter with the consideration of avoiding the generation of toxic gases, corrosive or halogenated gases in combustion, the trend is toward using non-halogenated flame-retardants.

2. ORGANIC POLYMER COATINGS
Organic polymeric coatings are expected to stop burning into flammable gases as well as to resist against decomposition over high temperatures. Flame retardancy in polymer composition arises primarily due to the existence of essential elements such as aluminium, boron, nitrogen, chlorine, bromine, phosphorus, or silicon. Phosphorus can be introduced into the polymer backbones and/or to the side chains in a variety of chemical structures. Polymers blended with Phosphorous are better choice for coating for making advanced polymer materials, because of their good mechanical strength, adhesion strength, excellent solvent resistance and good insulation property. The incorporation of flame retardant molecules directly into the polymeric backbone offer permanent flame retardancy in nanomaterials. Flame retardants such as phosphorus-halogen mixtures, ammonium phosphate and organophosphorus compounds were used to impart flame retardance. Phosphorus bound to hydrogen, carbon, sulfur, or nitrogen atoms will impart properties so much differing from each other that any generalization is hazardous. Furthermore, the flame-retardant efficiency of phosphorus compound was reported to be better than equal-weighted halogenated compounds and could be further evened up when phosphorus is covalently bound to the polymers consequently this improves polarity solubility in organic solvents adhesion to metal and this flame resistance of the polymer has been increased. Flame retardant such as phosphorus halogen mixtures, ammonium phosphate and organophosphorous compounds were used to impart flame retardance in nanomaterials. Nevertheless, some of the behaviors of the phosphorus compounds have already been explored and successfully applied for the polymer synthesis. Generally, the element phosphorus resembles carbon in its electronegativity and its preferred coordination number of 4. The distinctive features of the P-containing polymers have mostly influenced the choice of subjects for the present theme. Flame retardant materials are expected to stop burning into flammable gases as well as to resist against decomposition over high temperatures. Therefore, incorporation of phosphorus into organic polymers alters their physical properties relatively little but has the ability to suppress flammability. A few percent of P in the polymer is needed, although synergism with halogens allows going down to 1-2% to have an inflammable product.

3. ORGANO-PHOSPHOROUS COATING
Among these flame-retardant organophosphorus compounds generate little toxic gas and smoke and exhibit high flame-retardant efficiency while burning this is due to the fact that they take thorough a condense-phase mechanism. This mechanism leads to the production of relatively incompatible carbonaceous char, consequently fewer toxic gases.
are released. Organic phosphorus-based flame retardants such as phosphates, phosphonates, and phosphine oxides are majorly employed in electronic appliances owing to their thermal insulation characteristics. Organophosphates are mechanically combined in liquid type into resin formulations. They also reacted directly into the polymer chain. The reactive type organophosphorus flame retardants, confirmed the permanent availability of the flame retardant molecules which then add its significance in flame retardant chemistry. In Phosphorous based polymeric substances its able to considerably advance their flame retardancy when even a very little quantity of silicon compounds was added to epoxy which then enhanced both char forming in the condensed stage and the trapping of active radicals in the vapour stage. These reactive Organophosphorus flame retardants confirmed the permanent availability of the flame retardant molecules making them the most significant contributor in flame retardant chemistry. The additive approach may be simple, but the reactive approach (incorporating flame retardant molecule directly into a polymeric backbone) is considered to be more effective. The main advantage is the ability to bestow permanent flame retardancy and to maintain the original physical and mechanical properties of the epoxy polymer in a better way. The reactive flame retardant polymers, the phosphorus containing flame retardant seems to be more effective than the others. This is because organo phosphorus compounds generate little toxic gas and smoke and exhibits high flame-retardant efficiency of phosphorus compound was reported to be better than equal weighted halogenated compounds and could be further evened up when phosphorus is covalently bound to the polymers. The covalently attached phosphorus to the polymer backbone increases the polarity of the polymers. Consequently, the solubility in organic solvents, adhesion to metal and flame resistance of the polymers would be increased. The \( \text{–p=0} \) serving as an electron-withdrawing group in the epoxy consequently reduces the electron density of the oxirane rings. The effect makes the reaction between the oxirane ring and amine-curing agent to take place easily. While in flame, the phosphorus-containing groups undergo condensed-phase mechanism. This mechanism leads to the production of a relatively incombustible carbonaceous char. The decomposed pendant phosphate groups forms phosphorus-carbon bonds to yield high amount of char yield. During combustion, the released incombustible phosphorus char residue deposits on the surface of the rest of the non-combusted polymer and blocks the advancing flame. Furthermore, it is noteworthy that, employing phosphorus-based flame retardants is somewhat familiar, as it holds a 24% share worldwide.

4. ORGANIC-INORGANIC COATING

Further to the addition of Phosphorous, nanofillers could be considered for the flame retardant properties since the nanofillers of siloxane, carbon nanotube, graphenes, and or functionalized graphenes exhibits such in enhanced manner. Incorporation of siloxane into the polymer structure could be an attractive option in terms of their high thermal and flame proof, flexibility, and thermal stability properties. Organic–inorganic nano-blends from silicon materials such as clay, kaolin, usage as flame retardants are owed to the novel concept bestowed by the researchers. Much attention was redirected in employing layered silicates due to their enormous prospective for producing materials with improved flame retardancy besides to their advanced physical properties of nano inorganic elements and flame retardants, which proved in improving the flame behaviour of a wide variety of systems against flame. During the recent times, a number of researches were done on the synergetic combination. Considering the growth of the research in the flame retardance of materials, it is necessary to put forth the investigations carried out so far and their future scope as well as a document for the researchers, students and as well the business entrepreneurs. There are several ways the organic-inorganic (Organic = Phosphorous, Nitrogen, Carbon, P-C Bonds P-N Bonds, P-O-C Bonds; Inorganic = Siloxane, silica, nanoclays, Functionalised nanoclays, carbon nanotube, Functionalised nanotubes, graphene, grapheme oxides, functionalized graphenes, P-O-Si Bonds, P-O-Nanoclays, P-Si Bonds, P-O-Si Bonds, P-SiCNT, P-Si-Graphene, P-Si-Nanoclay) functionalities to be incorporated to the flame retardant coating materials. It was found from the reviews of articles that flame retardant properties enhanced furthermore when organic molecules is combined with inorganic molecules present in the nanomaterials. Further, it was also understood that there are several methods involved in the incorporation of inorganic molecules to the organic molecules such as melt, solution and insitu polymerizations. However, the solution method of preparation is preferred since it gives higher flame retardancy due to the exfoliated distribution of the nanoparticles throughout the matrix which is in homogeneous, when compared to other methods.

4.1. ORGANIC-INORGANIC COATING BY SOL-GEL TECHNIQUE

Solution method via Sol-Gel process is the easiest way of processing since aqueous-solvent miscibility is possible, which enables the hydrophobic polymers to get blended with hydrophilic nanoparticles with the two-dimension (2D) layered inorganic nanomaterials such as Montmorillonite, Layered double hydroxides, Layered metal phosphates, Graphene, Molybdenum disulfide, have found potential applications for development of several promising flame retardant nanocoatings. Layered double hydroxide (LDH), an anionic clay have the, general chemical formula \([\text{M}_{2+x}^{3+} \cdot \text{xM}_{3+x}(\text{OH})_{2}] \cdot \text{xH}_{2}\text{O}\) is a promising class of layered nanomaterial for preparing multifunctional polymer–matrix blends. The flame retardancy of LDHs suggests that the flame retardancy of LDH/
polymer blends depends on not only the dispersion of the LDH but also the endothermic decomposition of the LDH. LDHs, calcium aluminum undecenoate (Ca-Al LDH) and calcium iron undecenoate (Ca-Fe LDH), were incorporated into PMMA. The significant reduction (54%) in PHRR was observed in the case of PMMA/10% Ca-Al LDH blend, which was superior over that of PMMA/10% Ca-Fe LDH blend. The effect of the interlayer anion on flame retardant properties of high-density polyethylene (HDPE) nanocoating has been investigated. A series of Zn-Al LDH, with CO$_3^{2-}$, NO$_3^-$, Cl$^-$, and SO$_4^{2-}$ as the interlayer anions, blended with HDPE. With the LDH loading at 40 wt%, the PHRR was reduced by 24%, 41%, 48%, and 54% for HDPE/Zn-Al–Cl, HDPE/Zn-Al–CO$_3$ , HDPE/Zn-Al–NO$_3$, and HDPE/Zn-Al–SO$_4$, respectively.

5. FLAME RETARDANCY EXPERIMENTS DONE AT CLRI

Flame spread tests
A sample having A4 size and 1.5 mm thick for flame spread test was taken from crust leather and P-Polymer treated leather. The results of the flame spread tests ISO 15025: 2000 showed that the tested leathers meet the requirements of the set standards. No ignition after contact with flame application time 10 sec and very little differences in terms of appearance and subsequent evaluation of the burnt patch of the tested materials (i.e. measurement of length, area and perimeter (see Figure 1) was carried out using the visual rating systems. The materials provide high protection and are for use in the production of flame resistant leathers. The P-Epoxy- Urethane coating formulation for leather opens a new way to impart Phosphorous molecule which can take part in covalent bonding reaction during coating applications. It was observed that the fire retardants coated leather exhibited better thermal stability when compared with controlled leather.

5.1. FLAME RETARDANT STUDY OF P-EPOXY COATED LEATHER

Test method used for flame test by SGS company as per the flame spread ISO -15025: under Polypropylene gas atmosphere using Bunsen burner test having leather samples size 1 square feet i.e., A4 size, thickness under no criterial.

BEFORE TEST

P-I

P-II

AFTER TEST

P-Epoxy I (Tri-propane –Phosphorous Epoxy)

P-Epoxy II (Tri-butane –Phosphorous Epoxy)
5.2. FLAME RETARDANT STUDY OF P-EPOXY-URETHANE COATED LEATHER

CONTROL
Prior to Flame Test

SAMPLE
Prior to Flame Test

CONTROL
After flame test

SAMPLE
After flame test
6. RECENT DEVELOPMENTS

6.1. Zirconium phosphate/polymer nanocoating
As a typical layered metal phosphate, zirconium bis(monoiodrogen orthophosphate) monohydrate (a-type zirconium phosphate) (ZrP) has been widely employed to fabricate polymer nanocoatings. With the addition of 5 wt% zirconium phosphate, the PHRR value of nylon-6 is reduced by 27% as compared to that of pure nylon-6. In another case, compared to MMT and hectorite, ZrP/PVA nanoblend showed a faster charring process in temperature range between 200 and 350oC but higher char yield above 450oC. This earlier thermal degradation of the nanocoatings is attributed to the char formation catalyzed by ZrP. The presence of char layer inhibits the underlying matrix from being attacked by flame. Therefore, the lowered thermal stability is likely essential rather than a defect of this flame retardant system.

6.2. GRAPHENE / POLYMER COATINGS
Graphene, an atomically thick, two-dimensional carbon sheet. Due to its unique structure, graphene possesses exceptional physical properties, such as ultrahigh specific surface area (calculated value, ~2630 m2g−1), high electronic conductivity (~200 000 cm2V−1s−1), excellent Young’s modulus (~1000 GPa) and fracture strength (~125 GPa). Compared to other carbon fillers such as expanded graphite, nano-scaled carbon black, and multiwall carbon nanotubes, only graphene afford a significantly reduced PHRR (~76%) combined with simultaneously improved stiffness (+80%) and electrical conductivity (3 × 10−5 S cm−1). Graphene/water borne polyurethane nanoemulsions prepared by solution blending method displayed good flame retardant and smoke suppression properties with a significant reduction (25%) in total smoke release as well as lowered PHRR and THR, at 1 wt% graphene loading.

6.3. ECO-BENIGN ADDITIVE LOADED COATING
Recent researches on cellulose derivatives from wood, sea weeds, chitosan from various biological sources, are regarded as eco-benign’ additives as their use directs to a decrease in the detrimental impact on environment when compared with existing materials.

As athletes, Shriyans Bhandari and Ramesh Dhami ran hundreds of kilometres every year. They also ran through at least three to four pairs of sport shoes every year. The soles were in good condition but the shoe sides tore within months. The duo always wondered if they could find some use for the intact soles of these quality sport shoes. A bit of research led to the idea of refurbishing them into trendy slippers. That brainwave eventually spawned an eco-friendly enterprise that reuses shoe soles and is appropriately named Greensole.

DID YOU KNOW?
Worldwide every year more than 35,00,00,000 pairs of shoes are discarded, while as per the recent report by WHO, 1.5 billion people are infected by diseases that could be prevented by wearing proper footwear. While manufacturing a pair of shoes involves a total of assembling upto 65 discrete parts in 360 steps, which generates 30 lbs of emissions; equivalent to leaving a 100-watt bulb burning for a week.

VISION
To contribute to social good, by creating a self-sustaining infrastructure that facilitates the provision of the basic necessity of footwear to everyone, forever, environmental good, by refurbishing discarded shoes with zero carbon footprint and economic good by giving employment opportunities to refurbish shoes.

GREEN SOLE
www.greensole.in
From its advent way back in the 80’s to the present time, Computer Aided Designing has been making tremendous impact both in the design and manufacture of footwear. A stage has come wherein the complete process can be automated and executed with ease using modern technology.

**CAD DESIGN**
- Last Conception
- Digitizing
- Prototype Development
- 2D Pattern Engineering & 3D Design
- Sole Design & Conception

**Last Conception**

**The Conventional Approach**
The fundamental aspect of any footwear is the Last. The Traditional way of making lasts was to obtain a model which was turned and copied and then hand modelled to obtain a reference for the entire bulk production. This procedure used to be time consuming and the accuracy totally depended on the modeller who was handling the last.

**The Modern Approach**
Lasts can now be produced on a selection of numerically controlled lathes and milling machines using data output from footwear manufacturers’ CAD systems. Last shapes can be modified and new lasts created in the CAD systems and the machining controlled with their data. Variations in toe shape, heel curve and toe spring are easily achievable. Combining parts of different lasts also takes a few minutes with CAD technology.

It is possible to develop shoe design and tooling before the last physically exists because they are all derived from the same source data in the CAD system. Easy modification of last shapes through CAD has enabled the development of software and procedures for orthopedic and customized footwear. Modules for materials and labor costing, lay planning and style specification sheets can be used early in the development of shoe styles.

**Digitizing**

**2D Design**
Input has been a very key factor in any CAD application. In the case of 2D elemental design, the tablet is playing a very phenomenal role as an input device. Simple to use and broad compatibility. Some of it salient features are:
- Accuracy is solely dependent on the user.
- Accuracy ± .010 inch
- Prompt, Point, Run, Line, Track,
- Increment, Mouse and Grid Update operating modes
- Plug-and-play design; easily-installable software
- Broad compatibility

**3D Design**

**3D Digitization of “Shoe Lasts”**
This captures the “Shoe Last Shape and Contours” and is a last modelling system that emulates manual last design in a simple “visual” process. The Last is automatically scanned using the 3 D Last Scanner – which is a laser scanner to capture the last details very accurately. Skilled last makers can perform every function within the CAD environment that they would normally do manually. The resulting lasts can be milled using CNC machinery or exported as a digital e-Last. Some of the features include:
- Scanny 3D is a fully Automatic Scanner that can be used to Scan Lasts and Shoes.
• It is used to create 3D Last data and import in to the Design and Pattern Engineering systems.
• It has an Automatic Calibration procedure and very simple to use.

3D CAM Digitizer
Technology now brings in the 3D CAM digitizer which uses the concept of turning in order to digitize last. Cloud datas of points upto 1,00,000 are obtained during each revolution which can then be saved into universal formats such as STL to be directly read by softwares such as Forma.

• Unique global solution: 3D Digitizer + CAD + CAM + CNC
• High accuracy, high speed digitizer. Over 100,000 points in less than 5 min.
• Workstation concept.
• Digitizer + CAD in the same machine
• Change toes, make boots, adjust to soles... in very few minutes
• CAM system prepared for any CNC shoe last milling machine
• Simple and user friendly
• For model making or production.
• CAM included in digitizer or CAD options.
• One foot, One pair or two pair machines
• Model making or production
• Super-Grading option. Perfect grading from smallest to biggest sizes
• Network connection. Just digitize and mill. No disks needed
• Simple and intuitive user interface
• See your last before milling.
• Block display. You can view if the last fits in your block before cutting
• Finer milling in the toe provides superb quality
• User-controllable surface quality

Optical Scanner
Pioneering the area of Digitizing is the 3D Optical Scanner. It is a precision optical imaging device. The object viz., human foot, last or even a socks casting can be placed in contact with optical surfaces which generate data upto an accuracy level of ±0.5 mm in less than 4 sec.

Generally employed with eight cameras and four lasers, the Scanner is unmatched in the market for providing high speed, high resolution shape data essential in the digitization of shoe last shapes.

This unique system enables a last designer to dramatically increase productivity. Fit testing has been a major cause of concern for exporters. Foot data of customers can now be obtained from this Scanner and new lasts can be monitored for fits right from the development stage based on these data.

Some of the advantages include:
• Fast - obtains 3D surface scan of patient’s foot in less than 4 seconds.
• Accurate - to ±/-.5 mm.
• Versatile - transportable to different sites.

Prototype Development
The entire process of prototype development can be eliminated/reduced with the help of modern cad softwares. A virtual design library can be generated which allows the user to completely visualize a virtual shoe with very flexible parameters such as change in color, texture, leather etc. The library has a collection of various requisites such as Leather, Last, Soles, Ornaments etc., which can be assembled to create various designs taking care of the customer’s requirements at no cost and within short lead times.

Such programs contain all the functionality necessary to produce attractive and convincing shoe designs. Lasts can be imported directly in digital form and, where necessary, modified by the program to meet the design concept. 2D sketches can also be imported as scans, and the program can interface directly with conventional graphics packages like Adobe Photoshop. The 2D design can then be traced directly onto the last, and then units, colours and textures added to create a true 3D version of the design. Finally, buckles and other components can be imported and positioned to produce a complete 3D visualisation of the shoe.

These programmes provide a genuine opportunity to streamline production and cut costs by significantly reducing the need for the manufacturing of shoe samples. It also integrates fully with the Modern 3D pattern engineering systems, so any effects of the pattern engineering process can be seen immediately in the shoe design.

2D Pattern Engineering
A typical 2D setup has been shown with a input device being a tablet and the designing being done on the system leading to output in the form of cut patterns using a paper cutter or the advanced dieless cutting using a leather projection cutter.

Sole Design & Conception
Sole designing is another major field of Footwear design. The chart depicts the inputs in the form of freezed drawings, scanned data and sketches which are converted into the desired output using methodologies such as detailed design, reverse engineering with help of softwares such as Delcam/Pro-E.

The sole designing packages are now able to functionally simulate mold filling for injection molded parts. It works directly in co-ordination with the design software where user simply selects the material type and proposed gate (filling) locations. In just a few
minutes, the system provides on-screen animations of the mold filling, plots describing the modality of the design and the locations of potential problem areas such as weld lines and air traps.

**Some of the major advantages include:**
- Feature-based parametric part design
- Assembly tools and functionality
- Detailing and 2D drafting
- Associative drawing tables
- Photorealistic images
- VRML/HTML output
- Full industry standard and product interfaces

The deliverables like parts assemblies, drawings, BOM can be directly exported to software such as Pro/CAM, SHOEMASTER, DELCAM. They can also be imported/exported with other traditional CAD applications via industry standard translators like STEP; VDA; IGES; DWG.

**Sole Mould Development**
The shoe undergoes various development phases from the initial idea to the finished product. All these stages are now computerized with the help of state of the art technology.

The synergy of multipurpose software such as Creative, Forma, Pro-E has facilitated the complete control of the entire process of mould development. The idea in the form of sketches, images can be loaded into the software such as Creative. A 3D virtual image can be created thus giving a rough idea of the end result.

The present software is equipped with libraries of lasts which are catalogued based on various parameters such as gender, shape, fitting etc. Subsequently, lasts from the last library can be superimposed on the image and a last matching to the image can be picked up thus utilizing the existing last without additional investment.

After the last has been selected, the soles can be generated with the inner cavity pattern obtained from the last. This helps in avoiding the process of checking the soles for last as both of them are generated at the same time and one is a resultant of the other.

After the work has been carried out on the mould design, tool paths are set and the NC data is directly fed into a milling machine which helps in creating moulds. Moulds are then injected to obtain the prototypes which are then assessed. Once the prototypes are cleared, size sets are generated based on standard incremental data and rapid tooling is carried out to obtain the complete set of moulds.

The moulds are then either sent to the injection plant or sold to the customer based on his requirements. The entire process which generally takes about a month can now be done in two weeks with more accurate results and without any manual intervention.

**LAST MANUFACTURING**
The use of a computer based design system for lasts with automatic machinery managed by numerical control, is going to allow the manufacturers of lasts and footwear to improve their response times, the level of precision of their work and the possibility of sending by Internet the designs from remote sites in order for them to be manufactured where the appropriate machinery is available. This process is made interactive right from the prototype stage to the production stage with the help of universal file formats as an excellent way to transfer data.

**NESTING**
Present software has completely eased the concept of nesting with the help of auto layout generation irrespective of the quantity providing best results without any manual intervention. Savings in the range of 5-15 % can be easily achieved in small runs.
An automatic lay-plan calculation can be set according to a wide range of user-defined parameters, such as material directionality, constraints for pattern rotation, diagonal cutting for full material utilization. The latest versions only require the operator to choose the cutting tool and specify the number of parts needed for the operation to be done automatically. The nesting module easily accommodates both sheet and roll type materials and can nest an unlimited number of dies to create a full production schedule.

System can give unbeatable results by automatically calculating optimized lay-plans for a whole sequence of different patterns in different quantities, searching the best solution for everyone, and giving a single final machine program without manual intervention.

LEATHER CUTTING
Leather Cutting is now a three step process.
- Automatic Nesting
- Scanning (1 Operator)
- Leather Cutting (2 Operators)

The automatic nesting layout is created once the skin is scanned using a scanner. The defects are pre marked while scanning and instructions are given to the system to project the data containing the nested layout on to the skin. Based on these data the cutter starts cutting the leather. The cutting solution provides high-quality cutting that takes into account the constraints associated with the complex structure of leather, such as stretch, grain direction, visible and invisible defects, and thickness. This process is a perfect example of the WYSWYG concept. The advantages include:
- Extremely short introduction times
- Considerable material savings
- Only two operators process - 100 hides per 8-hour shift without any additional work
- The throughput is up to 160 cut hides, depending on the type of leather
- Improved cutting quality
- Optimum use of operator know-how
- Operators are relieved of physically strenuous tasks (e.g. manual cutting, lifting dies)
- Complete leather re-calculation with hide gross and net figures
- Statistical evaluation of all leather cuts

There are various methods of cutting technology that has evolved.

Knife Cutting
Knife has been the most popular of all tools and vastly used for cutting since the birth of CAM softwares. Some of the features include:
- Multi-functional tool heads for cutting with oscillating knife and dual punching
- Economic Price
- Vacuum pump integrated in structure
- Capability of cutting, printing, scanning, routing, milling, creasing, etc.
- Replacement knives are inexpensive

Laser Cutting
Knife has given way to the Laser technology. High accuracy cutting can be achieved with material thickness reaching upto 25mm based on the intensity of the laser beam. Laser is a hot cut procedure i.e. it generates a lot of heat while cutting which requires coolants in the form of air or water to control it. The solution for this has now been found. Some of the advantages include:
- High accuracy cutting. No post cut processing required.
- Great for cutting complex and intricate patterns of arbitrary shapes.
- A chiller system and compressed gas is required.

Waterjet
Waterjet cutting offers precision workmanship with a high degree of repeatability and positioning accuracy at affordable prices. The CNC-driven waterjet systems cuts material as thick as six inches.

Waterjet systems
- causes no thermal or mechanical distortion.
- features a very narrow cutting width
- produces excellent clean-edge quality
- produces no dust, pollutants or toxic fumes
- Increase lead time of new products
- No need for cutting dies
- Ideal for parts that are too simple or too complex as compared to traditional die cutting

Pure water cutting enables faster and better-quality cuts, and can be applied on virtually any material. The process does not generate heat in the material being cut, making it excellent for cutting. Water-jet cutting is based on the principle of pumping water at a very high pressure of up to 4,000 bar (60,000 psi) through an extremely fine orifice. This high-pressure jet of water is able to penetrate almost any material of virtually any thickness.

CNC MILLING / TOOL PATH GENERATION
CAD/CAM technology is evolving today to meet the specific needs for new tool path strategies to suit the HSM environment. Here, HSM can be defined as the use of higher spindle speeds and feed rates to remove material faster without a degradation of part quality. The goal is to finish mill moulds and dies to net shape, to improve surface finish and geometric accuracy so that polishing can be reduced or eliminated.

To facilitate high speed machining, a CAM system should:
- Maintain a constant chip load
- Minimize feed rate losses
- Maximize program processing speed
Functionality
Automatic tool path generation
Supports all machining technology: Milling, Turning, Sheet Metal, Wire EDM
Generate tool paths directly on the solid model
Automatic tool path creation coupled with graphical customization and editing
Tool path optimized based on in-process work piece state. Visual inspection of material removal

Tooling library
Process plan and route sheet development
Complete NC Programming Capability for:
- 3- to 5-axis milling
- 2- to 4-axis turning
- 3- to 5-axis mill/turn
- 2- to 4-axis wire EDM

The process of designing is one of the most intuitive and has become very easy with Shoe Design packages available. Never has the complete shoe been so naturally captured enabling rapid prototyping and dramatically reducing lead times. The software runs on virtually any PC with no special hardware required. The need for higher quality and faster introduction of new designs is placing extra pressures on every company making footwear. Being the first to have a new style on the shelf is often the difference between its success and its failure. With a range of advanced CAD/CAM software, footwear manufacturers can cut their time to market dramatically and so increase market share and profitability. In addition, the power and flexibility of the software can overcome restrictions to the designer’s creativity imposed by traditional methods.

The unique Total Modelling approach to CAD means that even complex lasts, soles and heels can be designed quickly and modified easily, giving much greater scope for experimenting with novel designs. Logos, textures and other decorations can be incorporated into product designs to help reinforce branding on all areas of the model. Automated grading then allows complete ranges to be developed rapidly from the initial design, leaving more time for creative work on new styles.

New concepts can be compared quickly onscreen in different materials and colours, and with a variety of decorations, allowing unsuitable designs to be eliminated without the time and cost of physical model making. These computer images can also be used to test the reactions of retailers and customers before any products are made.

Using CAD software to automate routine procedures increases consistency and reduces the possibility of mistakes. In particular, accurate grading of last, sole, tread pattern and heel gives perfectly matched components, thus easing assembly and finishing operations, and reducing failures in use. In addition, standard parts and sections, such as heels and toecaps, may be stored in a database for automatic incorporation into models.

Once the design has been completed, powerful manufacturing systems using CAM protocols can be used to generate machining data for either models or moulds. A wide range of strategies is available to enable fast, efficient machining and so give the quickest possible move into mass production. Finally, an inspection module allows prototypes, tooling and samples to be checked against the computer model to ensure that the designer’s intent has been captured faithfully in the end product.
Dr A Sivathanu Pillai is an Indian scientist who currently serves as Honorary Distinguished Professor at Indian Space Research Organisation and an honorary professor at IIT Delhi in the Department of Mechanical Engineering and a Visiting Professor at Indian Institute of Science.

He is the President of Project Management Associates and is the former Chairperson of the Board of Governors of the National Institute of Technology, Kurukshetra.

He formerly served as Chief Controller of Research and Development from 1996 to 2014 and held the rank of “Distinguished Scientist” from 1999 to 2014 at the Defence Research and Development Organisation at the Ministry of Defence of the Republic of India. He is also the founder-CEO and managing director of the BrahMos Aerospace Private Limited.

He also previously served as Vice President of International Project Management Association and as Special Secretary representing India in the India-Russia Inter-Governmental Commission on Military-Technical Cooperation.
Chennai Environmental Management Company of Tanners, CEMCOT in short, came into being on 15 July 2008 as an umbrella Special Purpose Vehicle, to establish six ZLD projects, four in Vellore district and one each in Pallavaram and Dindigul. Many of these projects were completed about four years back, the last one to be completed was at Dindigul in 2017. All the ZLD systems established have been operating successfully for many years now. To highlight its success and to outline its future plans, CEMCOT organized a small celebratory function on 27 July 2018 at the Taj Coramandel, Nungambakkam, Chennai. The function was presided over by Shri MM Hashim, the doyen of the leather industry in the country, a man of many parts and also Chairman Emeritus of CEMCOT. Shri Mohamed Nasimuddin, IAS, Principal Secretary to Government, Environment and Forests Department, Government of Tamil Nadu and Chairman, Tamil Nadu Pollution Control Board, graced the function as its Chief Guest.

Shri Ramesh Prasad, the live wire Chairman of CEMCOT, welcomed the gathering and said that CEMCOT deemed it a privilege to have such a galaxy of distinguished persons both on and off the dais. He especially thanked the Chief Guest for taking time to attend the function. He specifically welcomed Shri Habib Hussain, former Chairman of CLE, Dr. Sukumar Devotta, former Director NEERI and Shri E.N.Murthy, IAS (Rtd), former Joint Secretary of DIPP, Government of India.

Padmashri Shri M. Rafeeqe Ahmed, former Chairman of CLE and Chairman of AEDOL, in his special address referred to the current situation in Tamil Nadu with regard to leather sector. He felt that due to the tremendous increase in operational cost of ZLD systems on the one hand and also because of uncertainties affecting the sector for a variety of factors, there was migration of tanning industry from here to other states. He was worried that if this trend was not arrested urgently by appropriate policy and administrative support, the further decline of this sector cannot be arrested. In particular he referred to the problem faced by some tanners resulting in lower capacity utilization; and desired that the CETP management should have the liberty to transfer such capacity to any other member, provided the total effluent generated is within the approved capacity of the CETP. He suggested that this would help the viability of CETP considerably. He appealed to the Chief Guest and the Government of Tamil Nadu to look at the problems of the sector with sympathy and render support.

Shri Aqeel Ahmed, Vice Chairman, CLE, referred to the role played by Shri Rafeeqe Ahmed and Shri Hashim for the betterment of the industry over the past many years. He also noted that Dr. T. Ramasami and Shri A. Sahasranaman also worked with these stalwarts in strengthening the industry all over the country. He congratulated CEMCOT for its wonderful achievements and hoped that it would continue to serve the industry with dedication in future too.
Padma Bhushan Dr. T. Ramasami, former Secretary to Government of India, Science and Technology, said that the sustainability of an industry depended on three main stakeholders — the public, the business and the government. He referred to the role played by CLRI along with NEERI in 1996 when many tanneries were closed down on the orders of Supreme Court. He felt that with changing times any industry must change. New challenges on the environment front arise not only in India but all over the world. It is for the industry to look at these as opportunities and convert them to their advantage. He foresaw that even in the USA the ZLD system may become compulsory as water scarcity was staring in the face of many countries and governments. He congratulated CEMCOT for its achievements but added that the future role of CEMCOT must focus on ensuring sustainability of the sector.

Shri A. Sahasranaman, Hon’y Advisor, CEMCOT, traced the history of environment management in tanning sector over the past over two decades. He said that when the challenge of TDS arose for the first time in 1997, UNIDO under its Regional Programme for South East Asia, had specifically taken up four pilot demonstration projects — one dealing with use of lower TDS effluent from semi finished to finished leather processing tanneries for irrigation; two, a pilot RO plant with 1 cu.m. per hour capacity in a working tannery; three, one accelerated solar evaporation system in a working tannery to demonstrate how solar evaporation could be accelerated; and, four, a study on the implications of mechanical evaporation of RO reject. While the results of usage of low TDS effluent for irrigation proved to be a feasible option, based on a 5 year study of soil and ground water in a mini forest developed near SIDCO CETP in Ranipet, before it was accepted by TNPCB, there was a change of leadership. RO was found technically feasible but mechanical evaporation was reported to be highly energy intensive and hence too costly. Accelerated solar evaporation was found appropriate for small RO plants. The results were conveyed to Chairperson of TNPCB of the time and it was suggested that dilution of high TDS effluent with sewage, as practiced elsewhere in the world, appeared the most optimal solution. Eventually, however, TNPCB mandated ZLD for tannery and textile sectors for its own reasons.

Shri G. Sundaramurthi, MD, CEMCOT, then made a power point presentation detailing the history of creation of CEMCOT and its varied contributions to the tannery sector over the past ten years. He said that though CEMCOT had succeeded in creating ZLD systems, for the first time in the world, for tannery sector, it was faced with many problems. First, the accumulated mixed salt recovered from the rejects of RO was mounting in volume, needing an urgent solution. Some efforts were underway in collaboration with the Central Salt and Marine Research Institute, Bhavnagar but it needed support of TNPCB to take it to its logical conclusion. He also referred to the high cost of operation of ZLD systems, ranging between Rs. 450 and 600 per cubic meter of waste water treated. He also said that in view of the establishment of ZLD systems, the rule relating to prevention of tanneries within 5 km radius of rivers and water bodies was not relevant. Also if a CETP wanted to transfer capacity from one member to another due to fluctuating business fortunes of individual members, this may be allowed, with TNPCB being informed duly.

Dr. B. Chandrasekaran, Director CLRI and Shri R. Selvam, IAS, Executive Director, CLE, also felicitated CEMCOT on its achievements.

Shri MM Hashim in his presidential address felt that the industry must adopt an optimistic attitude towards future. He supported the demand of Shri Rafeeqe Ahmed regarding CETP being given the authority to transfer capacity from a non performing tanner to a performing tanner within the allotted capacity of CETP. He also requested the Chairman to allow CETPs to expand capacity of their Safe Landfills where the existing ones have reached their full capacity as subsidy was available for such projects from Government of India. He specifically referred to the general status of tanners in Tamil Nadu, majority of whom were from micro and small scale sector and therefore the Government may adopt a sympathetic and helping attitude towards the industry. While the industry was fully committed to maintaining environment and has demonstrated its commitment through establishment of ZLD systems all over Tamil Nadu, the difficulties being faced by the industry to sustain itself have to be appreciated by the Government.

Shri Md. Nasimuddin, in his address, thanked CEMCOT for providing him the opportunity to attend the function and felt that he could gather a lot of useful information relating to the industry. He said that while the Government was all for promotion of industry in the state, at the same time, it had to ensure that the environment was protected for future generations. He said that his philosophy was that ‘the cost of non compliance must be made greater than the cost of compliance’ so that the industry willingly conformed to the regulations. He said that closing an industry was not a pleasant task and he would very much like to desist from this but this can happen only when the industry respected the pollution control norms and conformed to them. With regard to the specific suggestions and demands made by the industry he assured that he would look at them with sympathy. He mentioned that with regard to CETP transferring capacity amongst its members, already a decision had been taken and appropriate orders would issue shortly. Likewise, regarding landfills too, orders would issue. He appreciated the good work of CEMCOT but cautioned that ensuring sustainability of the sector was vital and towards this CEMCOT should focus its attention in future.

Dr. KV Emmanuel, Executive Director of Indian Leather Industry Foundation, a former Technical Director of CEMCOT, proposed a vote of thanks to the Chair, the Chief Guest and all dignitaries.
At the Executive Committee Meeting of the Indian Shoe Federation held on 10th August 2018 at Hotel Radisson Blu in Egmore, Chennai; President & Members discussed the export figures based on the inputs from the Council for Leather Exports. It was felt that there was a marginal improvement in the exports of Leather Footwear and Footwear Components. The worrying factor was the decline in demand for finished leather as compared to the last year. The members attributed the decline to the fall in raw material prices of hides and skins and felt that this was a temporary phase.

On the subject of prices of raw material from cow, Mr K R Vijayan, President, ISF opined that the prices were showed a downward trend. To this, Mr Sateesh jadhav' added that the prices of raw hides from America too were down by about 30%. Mr Yavar Dhala informed the members that the decline was only for bovine and not for other materials. Mr Irshad Mecca added that the raw material prices could slide further if not for the demand from the automobile industry. He further stated that leather usage is liable to go up in other industries other than footwear.
Mr M Mohammed Hashim
Chairman, KH Group & doyen of the Indian Leather Industry
honoured with “Lifetime Achievement Award”
by the Council for Leather Exports

Mr M Mohammed Hashim is the Chairman of KH Exports India P Ltd., Chennai. The company manufactures and exports Leather and Leather Products like footwear, handbags, wallets, Belts, gloves etc. with an annual turnover of more than Rs 1000 crores. Their tanneries and factories spread from Chennai to Ranipet to Melvisharam.

Mr M Mohammed Hashim is the Founder Chairman of the Council for Leather Exports (CLE) and has held office for 14 years. He was the President of All India Skin & Hide Tanners and Merchants Association (AISHTMA) during 1989-90, 1995-99 and its Vice president from 1999 till date.
Mr Hashim is the Founder Chairman of Chennai Environmental Management Company of Tanners (CEMCOT) from 2008 to 2016. From 2016 onwards, Mr Hashim is the Chairman Emeritus of CEMCOT.

We at CSIR-CLRI take immense pride as he has been the Executive Committee member of the Research Council of CSIR from 1998 to 2006.

Mr Mohammed Hashim is the Chairman of KH Foundation in Melvisharam. Founded and managing 125 beded Apollo KH Hospital at Melvisharam and KH Matriculation Schools for Boys and Girls.
He was the President of Muslim Educational Association of Southern India (MEASI) which governs The New College and many other educational Institutions.
Mr Hashim is the Vice President of The Anjuman-e-Himayat-e-Islam, Chennai managing an orphanage and many educational institutions. He holds key positions in various other social and educational institutions.
The Union Minister for Commerce & Industry and Civil Aviation, Shri Suresh Prabhakar Prabhu presenting the Lifetime achievement award to Shri M. Mohamed Hashim, founder Chairman Council for Leather Exports, at an interactive session on Export strategies for Leather and Footwear Sector, at Chennai on August 04, 2018