Instructor-Led online CAD/CAM courses at CSIR-CLRI
Yet another month is gone with COVID-19 very much in picture. States like Kerala have started looking at it as community spread. CLRI and its stakeholders need to move ahead with our day to day activities with caution. As one WhatsApp message described, COVID-19 has taught us to go back to our pasts where hygiene, social distancing etc., were in vogue. Students, children and teachers around us are under pressure as learning and teaching the e-way has become the new norm. It has been said somewhere “If we’re going to have a bright future, we need to grow and prosper from the lessons of our past”. The past of CLRI has been one of hard work that led to the institute's one-upmanship in areas of research, training and societal programs.

We need to shake ourselves up to return back to that glorious days when the institute had a strong foothold on all four quadrants of CSIR contributions – public, private, social and strategic. Fundamental Basic Research and Niche creating high science projects have been sanctioned by CSIR. Our own inhouse research programs are on. It is time for us to surge ahead. Let us join together to do wonders for the organization and the industry.

JAI HIND
Generally, the foot of elderly people or those suffering from diabetic neuropathy would be numb. They would not be having any sensation/less sensation of touch in their feet. This may result in acute pain in the foot at a later part of the day. Suitable footwear will relieve them from such pain if worn during walking. There are some places where regular footwear may not be convenient to use on foot. On such occasions, socks would be sufficient to do well for them. There is a slight hitch in using normal socks. These may get worn soon or may get wet or small stones may pierce under their foot, thereby not providing enough comfort that they would need. Also, elderly people find it difficult to walk on ceramic tiles flooring because of its slippery nature.

Hence an idea was devised to provide comfort for these people. An insole pattern for socks of free size was developed. The edges of this pattern were reduced slightly, and another pattern for sole was developed. The insole pattern was used to cut on 5mm foam. Using the sole pattern, rubber sole was cut of 5mm thickness. The insole was inserted into the socks and placed them on the foot portion. The sole was placed outside the sock and attached to the sock. The adhesive applied on the sock ensured that the insole and sole were placed in unison.

While the sock looks like any other socks, the sole and foamed insole gives comfort to the wearer.
Introduction

The puncture resistance is a mandatory property for the mid-plate component in the safety footwear to avoid accidents such as sharp objects like nails piercing in the foot through the safety footwear. The Fibre Reinforced Plastics (FRP) composites in multiple layers molded with formulated epoxy resin composition, comprised with the constituents such as a polypropylene-glycol, aqueous based Polyurethane are used to prepare epoxy matrix formulation to exhibit superior flexibility when it is reinforced to make Fabric Reinforced Plastic composite in sheet form, and it is easy to cut the mid-plate component. This composite formed by the formulated epoxy resin with FRP has achieved good results in mechanical testing of compressive load by nail penetration of about 2000 & 2002N, tensile strength value of about 66.92MPa and additionally determined the thermal property by the test conducted by Thermo-Gravimetric Analysis (TGA) test provided the good results of decomposition temperature of about 798°C, with residual mass of 65.7%. These properties of FRP composites are highly suitable for safety footwear component as mid-plate, and it is indispensable for the resistance for nail penetration.

Comparison between Steel Mid-Plate and FRP Mid-Plate

<table>
<thead>
<tr>
<th>No.</th>
<th>Steel Mid-Plate</th>
<th>FRP Mid-Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Flexibility is poorer than FRP</td>
<td>Flexibility character is good</td>
</tr>
<tr>
<td>2.</td>
<td>Thermal conductivity is high</td>
<td>Thermal conductivity is very low</td>
</tr>
<tr>
<td>3.</td>
<td>Puncture resistance is lower than FRP</td>
<td>Puncture resistance is high</td>
</tr>
<tr>
<td>4.</td>
<td>Weight is higher than FRP</td>
<td>Weight is less than steel mid-plate</td>
</tr>
</tbody>
</table>

The metal mid-plate is the currently available puncture-resistant footwear. It is having more weight, conducts electricity and also heat. Workers who wear footwear containing steel mid-plate are, thus, more subject to frostbite when working in cold environments. Further, footwear with metal mid-plates cannot be worn by electrical workers. Instead, a non-conducting FRP mid-plate is required for those engaged in electrical work. Resilient mid-plates in FRP overcome all the lacunae of steel mid-plate. FRP manufacturing processes, however, are subject to numerous environmental issues, which tend to increase the requirements of fibre materials. Moreover, the FRP mid-plate must be quite thick to provide the required puncture resistance, and it reduces both the comfort and flexibility of the shoe. Mid-plates have been developed which comprise multiple layers of stacked fibrous materials or fabric which are bonded together by synthetic resins and the like to form resin-impregnated laminates.

Fibrous materials previously identified as useable include spun glass fibres or nylon. Impregnation of the fabric is indicated as necessary to provide the desired puncture resistance. However, the resin impregnation process adds to the cost of materials and labour, reduces the flexibility of the resulting mid-plate and generally adds to the overall thickness of the mid-plate.
**Essential need for FRP mid-plate in safety shoe/ protective footwear**

Manufacturing, construction and demolition sites often have the high risk of exposure to sharp objects such as protruding nails, which present a significant hazard to unwary workers. When stepped on, upturned nails in a board or the like easily penetrate the worker’s boot and foot, causing considerable pain and injury. Such a puncture wound can hobble a worker for weeks and requires serious medical attention to avoid tetanus or other anaerobic bacterial infections.

![Mid plates in FRP material](image)

The vital objective of this work is to provide a puncture resistant sole for boots or shoes; to provide such a sole which is relatively light weight; to provide such a sole without appreciably reducing shoe flexibility; to provide such a sole which is neither thermally nor electrically conductive; to provide a puncture-resistant mid-plate for forming such a sole which is relatively thin, relatively comfortable to use, could be purchased separately as an insert for an existing boot, does not slip when positioned within a boot, relatively inexpensive to manufacture, and is particularly well adapted for its intended purposes.

Any puncture-resistant mid-plate which appreciably decreases the flexibility of the footwear or which is too thick is uncomfortable for workers to wear, and workers will remove the puncture-resistant footwear when supervisors or regulators are not present. In addition, many workers wear safety shoes only when doing jobs requiring safety shoes and then change to more comfortable shoes when they are not needed. A more comfortable shoe would make these changes unnecessary and, as a consequence, reduces worker downtime. There remains a need for a way to increase the puncture resistance of safety footwear and the like without sacrificing comfort and flexibility or significantly the weight of the safety footwear.

**For details, please contact:** clriinfo@clri.res.in; akshayaraman@clri.res.in

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**Technical services from Design & Fashion Studio, CSIR-CLRI**

We at the CSIR-CLRI Design & Fashion Studio would like to offer our services in the areas of:

1. Design ideas (including engineering) and colour trends for a new range of flip-flops
2. Test and evaluate flip-flops being manufactured by you and do a comparative study with other brands
3. Set-up a mini ‘physical testing laboratory’ and train your personnel in the area of design development and physical testing
CSIR has sanctioned the following major lab projects for CSIR-CLRI under Focused Basic Research (FBR), and Niche Creating Science Projects (NCP) categories in themes such as Chemicals (including Leather) and Petrochemicals (CLP), and Agriculture, Nutrition, and Biotechnology (ANB) for a period of 3 years (April 2020 -March 2023).

- FBR - Innovative Fundamental Research for attaining Sustainability in Leather Sector (IFRES)
- FBR - Spatial regulation of Collagen Orchestrated Protein Dynamic Exposition in the skin (SCOPE)
- FBR - Developing a Bio-fabricated Leather
- NCP - Chemicals for Low-Temperature Applications of Leather in Strategic sector (CHILLS)

**Innovative Fundamental Research for attaining Sustainability in Leather Sector (IFRES):**
The project centers on the development of novel eco-benign and bio-based products such as metabolites and enzymes from microbial sources, extracts from plant derivatives and other organic chemicals, and optimization of eco-benign processes in pre-tanning, tanning, post-tanning and finishing operations in leather processing to attain sustainability in the leather sector.

**Spatial regulation of Collagen Orchestrated Protein Dynamic Exposition in the skin (SCOPE):**
The project focuses on understanding the regulation of collagen interactions with the other macromolecules contributing to the structural and functional integrity of the tissues. It also emphasizes on modulating aberration based on the collagen interactions in disease/connective tissue disorders and overcoming these aberrations using Nano interventions.

**Developing a Bio-fabricated Leather:**
The project proposes to develop microbial cells that will be engineered to biosynthesis collagen or collagen-like proteins. The collagen-like protein will be then purified, and bio fabricated to create the bio-leather material. In the proposed approach, it is aimed to recombinantly express the collagen, thus, the obtained product will be assured for quality and purity for use in therapeutic applications.

**Chemicals for Low-Temperature Applications of Leather in Strategic sector (CHILLS):**
The project focuses on addressing the technology gap for chemicals/combination materials employed for filling (in leather terminology-Retanning agent), lubrication (in leather terminology-fatliquoring), adhesion, weight and impact for making defense gloves/garments for strategic sector applications, that are used in low-temperature conditions, more so in the -30° to -10°C range.
The Government of India has allowed corporate India to use their mandatory Corporate Social Responsibility (CSR) spending for investments in publicly-funded incubators and contribute to research efforts in science, technology, medicine and engineering at major institutions and bodies. This 2% CSR fund of average net profit of companies over the last three years can be spent on incubators funded by Central or State Government or any agency or Public Sector Undertaking of Central or State Government, and, making contributions to public-funded Universities, IITs, National Laboratories and Autonomous Bodies (established under the auspices of ICAR, ICMR, CSIR, DAE, DRDO, DST, MEITY) engaged in conducting research in science, technology, engineering and medicine aimed at promoting Sustainable Development Goals (SDGs).

It is a matter of pride for the business entities to participate in the national development by investing in an ethical and transparent way to contribute positively towards the growth as well as the welfare of the society. This investment in national development plays a critical role in enabling society to operate effectively. Considering that we are presently in a knowledge-based society, an investment towards R & D as well as S & T interventions is expected to lead to a very high degree of social empowerment, economic development and environment compliance.

CSIR-CLRI is in the process of attracting the Corporate Social Responsibility funds of its stakeholders / Indian Industries for investment in the following S & T interventions of CSIR-CLRI towards addressing the R & D and technological demands of the leather and products industry and augment the socio-economic benefit to the society.

- Creation of infrastructure and specialized facilities within the campus for
  - Conducting skill development programs and
  - Conducting research and development in science and technology relevant to leather and allied industries
- Support for technology-driven projects for the benefit of the Industry
- Support for projects in futuristic technology areas for the benefit of the S & T development of the Industry
- Research fellowships for the specified project objectives.

**CSIR-CLRI Projects and Programs for deployment under CSR funds to achieve Sustainable Development Goals (SDGs)**

**Indian Foot Sizing system for children:**
Enhance the knowledgebase on India specific foot sizing system for the children of the age group of 6 to 15 years.
- To carry out a scientific anthropometric survey of the feet of children (region-wise)
- To analyze the collected data statistically
- To validate the India specific foot sizing system for correct fitting of foot dimensions of feet of Indian children

**CSIR-CLRI Process and Product technologies:**
Demonstration of technologies and conducting workshops to augment the awareness of the significance of these technologies to the leather cluster and common people
Liquid waste management and Solid waste management technologies of CSIR-CLRI
- Demonstration of liquid and solid waste management technologies to the tannery clusters on the manufacture of value-added products.
- Demonstration and validation of the use of the value-added products of the solid wastes of the leather industry to the user industries

Skill Development and Training Programmes - Training the beneficiaries in leather, leather products and allied sectors:
- Vocational training courses in leather and leather products
- Conducting Skill Development programs and assessing the candidates
- Research programs for AcSIR students
- Dissemination of science to school students
- Training of Trainers under Skill Development programs

Skill development programs predominantly for women / under-privileged people to augment the quality of life:
Training the beneficiaries in product making in leather and allied sectors to empower them to earn their livelihood.

The Institute – Industry linkage has had many success stories to its credit. On the same lines, we look forward to working with you in this initiative as well to achieve Sustainable Development Goals for the well-being of the Nation.

For Project Guidelines and further details about CSR projects/programs, please refer to https://clri.org/Events/CSR/index.html

Workshop on “Footwear Digital Design with ICad3d+”
Demonstrated by INESCOP, Spain & CFTI, Chennai

In this modern world, it is our responsibility on change over or upgradation in the processes and especially in the first and foremost process of designing part. ICad3D+ is the software for footwear design and pattern engineering than integrates into a single program two different environments, 3D design and 2D patterns, which works in parallel and simultaneously. By using the software named as ICaD3D+ and this as especially designed for footwear designing process. This provides the ways to face the challenges in shoe factories such as marketing (shoe combiner /shoe viewer), web materials platform medium, accurate costing and change model between lasts possibilities, ease of importing external digital last, ease of accurate flattening from 3D to 2D, ease of design changes by any stage, ease of 3D printing technology and high quality of the scanner for fit parameters. Working with ICad3d+ is very simple and intuitive. The first step is to start working are importing a digital last, preparing this last for the model design and start drawing on the last.

This software provides fruitful technology solutions for the footwear designing process and pulls up to the next level.
Visible Light-Induced Photochemical Stabilization of Collagen in Green Solvent Medium

Collagen is a major structural protein, and it is also the basic raw material for many biological and industrial applications. Improving the physicochemical properties such as enhancing thermal stability, mechanical properties etc. One of the ways to improve the physicochemical properties of proteins would have been the crosslinking, and in this work, we have adopted a green method using the visible light and green solvent such as ethanol. The visible light absorbing photosensitizers such as methylene blue (MB) and erythrosine B (EB) generates reactive oxygen species which react with surrounding molecules like tyrosine and phenylalanine of collagen and leads to the crosslinking between them. The collagen fibre induced by Visible light irradiation with different concentration of sensitizer maintained the tribble helical structure of collagen. The irradiated collagen fibre has higher hydrothermal stability and their enzymatic degradation rate in vitro dependent on the concentration of sensitizer and ammonium persulphate (APS). The change in the triple-helical conformation of collagen was studied using circular dichorism (CD) spectra as a function of the concentration of photo sensitizers. The conformation and thermal properties of the photo chemically cross-linked collagen were investigated using Fourier transformed infrared spectroscopy (FTIR), Raman spectroscopy, florescence spectroscopy and shrinkage temperature of collagen were observed using differential scanning calorimetry (DSC). The complete results suggested that the crosslinked collagen fibre prepared by Visible light irradiation crosslinking maintained the triple-helical conformation possessed improved thermal stability and enzymatic degradation.

Presented by
S. Nagaraj, Research Scholar,
Advanced Materials Laboratory

Biomaterial Functionalized Graphene-Magnetite Nanocomposite: A Novel Approach for Simultaneous Removal of Anionic Dyes And Heavy-Metal Ions

Despite of immense application potential of graphene in wastewater treatment, the colloidal stability, aggregation and recyclability remain a major challenge. To address this issue, we report biomaterial functionalized graphene-magnetite (Bio-GM) nanocomposite as a novel recyclable material for the treatment of wastewater containing dyes and heavy metal. The integration of biomaterial, including living cells of Shewanella oneidensis with graphene-magnetite nanocomposite was characterized through UV-vis, FTIR, FESEM, VSM, contact angle and fluorescent microscopic studies. The Bio-GM nanocomposite exhibited excellent adsorption capacity towards dyes and Cr⁶⁺ in both single and multicomponent system with removal capacity of 189.63±7.11, and 222.2±8.64 mg/g of dyes and Cr⁶⁺, respectively suggesting selective binding capacity and high adsorption efficiency of Bio-GM nanocomposite. In the adsorption coupled redox reaction, the Cr⁶⁺ was reduced to Cr³⁺ through the biocatalytic activity of Bio-GM nanocomposite. The nanocomposite is easily regenerated and reused for multiple cycles of adsorption-desorption studies without the release of graphene and magnetite that reduces environmental hazards.

Presented by
B. Ramalingam, Research Scholar,
Biological Materials Laboratory
Biosynthesis of Tailor-Made Collagen for Tissue Engineering Applications

Collagen plays a critical role in the structural design of the extracellular matrix (ECM) and cell signalling in mammals, which makes it one of the most promising biomaterials with versatile applications. However, there is a considerable concern regarding the purity and predictability of product performance. At present, it is mainly derived as a mixture of collagen (different types) from animal tissues, where selective enrichment of a particular type of collagen is generally difficult and expensive. Collagen derived from bovine poses the risk of transmitting diseases can cause adverse immunologic and inflammatory responses. Hence, recombinant collagen can be a good alternative. Nevertheless, the necessity of post-translational hydroxyproline (Hyp) modification limits the large-scale recombinant collagen production. Here, we recombinantly expressed the Collagen-like protein (CLP) and genetically introduced the Hyp in the CLP to form a higher-order self-assembled fibril structure, similar to human collagen. During the current study, it was observed that the Hyp incorporated CLP protein (CLHP) formed stable triple-helical polyproline-II like structure and self-assembled to form fibril at neutral pH, which had an initial lag phase followed by a growth phase similar to animal collagen. In contrast, the higher-order fibrillar assembly was missing in the nonhydroxylated CLP. This study demonstrated that CLHP self-association is based on the common underlying lateral interactions between triple-helical structured proteins, where the hydroxyproline interceded significant stable hydration network. Hence, this work will be the first fundamental empirical research for flexible modifications of recombinant collagen for structural analysis and biomedical applications.

Presented by
M.Ilamaran, Research Scholar,
Biochemistry and Biotechnology Laboratory

Consultancy Projects - Agreement Signed

Consultancy Agreements

- A Consultancy Agreement has been signed between CSIR-CLRI and M/s. Frigerio Conserva Allana Pvt Ltd, Uttar Pradesh on 29th June 2020 to carry out "A comprehensive Environmental Audit to ensure continuous compliance to the regulatory requirements".

- A Consultancy Agreement has been signed between CSIR-CLRI and M/s. Intexso Bio chem Private Limited, Maharashtra on 13th July 2020 for "Technical Evaluation of antiviral/antibacterial product for the Leather Application".

- A Consultancy Agreement has been signed between CSIR-CLRI & M/s. Zsivira Chemie Merk Private Limited, Chennai on 21-07-2020 for Evaluating the antiviral product SUR-VIRAL® C19 in finishing operation of Leather Application. The product has been indigenously developed by the company.
CAD for Footwear

Online instructor-led training

Pattern design engineering is a niche element in the Footwear design and production. Conventional, manual methods of pattern designing and grading requires skilled personnel and is time consuming. Use of computer aided design (CAD) systems have rendered much of the above exercises simple and precise.

The Course:
- Digitizing a Standard
- Style Line Modifications
- Pattern Creation
- Pattern Engineering
- Size Grading
- Style Transfer and Plotting/Cutting

How we do:
Live CAD system demonstration will be arranged to handle various menus/options through online video Apps. To clear the doubts one to one sessions with faculty will be arranged.
Live demonstration of Pattern digitization, Style Line Modifications, Pattern creation and grading will be conducted.

Prerequisite:
Computer system with broadband internet connection, Knowledge in computer basics.

To whom:
Industry personnel / designers / design faculties who have prior manual pattern designing knowledge.

Duration: 2 weeks
After Successful completion course certificate will be issued.

Course fee:
For Indian students: Rs 10,000/- + 18%GST
For International Students: USD 300/-

Payment method:
For Indian students: through SBI collect
International students: through wire transfer

For Enrollment fill the form: https://forms.gle/h8BKsBb2d8dr8CeJ8

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E-mail: spdc@clri.res.in
chord@clri.res.in
URL : https://clri.org
Pattern design engineering is a niche element in the apparel design and production. Conventional, manual methods of pattern designing and grading requires skilled personnel and is time consuming. Use of computer aided design (CAD) systems have rendered much of the above exercises simple and precise.

**The Course:**
- Pattern Digitization
- Pattern creation
- Pattern grading
- Marker making
- Pattern plotting/Cutting
- Pattern conversion Tools

**How we do:**
Live CAD system demonstration will be arranged to handle various menus/ options through online video Apps. To clear the doubts one to one sessions with faculty will be arranged. Live demonstration of Pattern designing, grading and marker making will be conducted.

**Prerequisite:**
Computer system with broadband internet connection, Knowledge in computer basics.

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Pattern design engineering is a niche element in the Accessories design and production. Conventional, manual methods of pattern designing requires skilled personnel and is time consuming. Use of computer aided design (CAD) systems have rendered much of the above exercises simple and precise.

The Course:
* Pattern Digitization
* Pattern creation
* Nesting
* Consumption Calculation & Reports
* Pattern conversion Tools

How we do:
Live CAD system demonstration will be arranged to handle various menus / options through online video Apps. To clear the doubts one to one sessions with faculty will be arranged.
Live demonstration of Pattern creation, nesting and consumption calculation will be conducted.

Prerequisite:
Computer system with broadband internet connection, Knowledge in computer basics.

To whom:
Industry personnel / designers / design faculties who have prior manual pattern designing knowledge.

Duration: 2 weeks
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Shri P. Mohanakurup  
Sr. Technician (2)  
Electrical Division

He joined CSIR-Central Leather Research Institute (CLRI) in November 1983 and has served the Institute for 37 years. He was well versed in handling and maintaining all types of electrical works.

The Director and Staff wish him good health and happiness on his superannuation.

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Letter of Appreciation from a Senior Citizen about CSIR-CLRI Dispensary

“I feel extremely happy to say a few words of appreciation for the excellent functioning of CLRI dispensary inside the complex of CLRI. The maintenance, service and the kind of cooperation extended to the senior citizen like me is marvelous. A very small suggestion if I may is, this dispensary may be held as an example as to how any Govt. clinic should function. At this moment when an emergency is there, their services are appreciable.”

I salute you all sir,

Lakshmi Vasudevan, Senior citizen.
CSIR-CLRI

World’s Largest Leather Research Body. A Dependable Source for Technologies & Services

Cutting Edge Technologies in Leather Processing
Consultancy Services
Education & Training
State-of-the-art Testing Facilities
Health Care Products
Environmental Technology
Leather Chemicals
Leather Processing

Striving for Excellence and Global Leadership in Leather Technology

Global Leadership in Leather
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