TECHNICAL ACTIVITY CARRIED OUT BY CENTRES / OVERSEAS CHAPTERS

Name of Centre / Overseas Chapter:	Durgapur Local Centre

Title of Activity:	One day seminar on "Manufacturing Process and Impact on Environment"		
Activity under Divisional Board (delete which are not applicable):	ENDB		
Date:	4th May 2018	Venue:	Seminar hall Rahul foundation

Dr P K Sinha, Principal, DIATM delivering his address and sitting (l to r) : Mr R K Roy, Dr C T Bhunia, Dr P K Chatterjee, Dr B Ghosal, Dr A K Das and Mr M N Bandyopadhyay

Dr P K Chatterjee delivering his presentation

In Inaugural Session the distinguish dignitaries on the dais were: Dr C T Bhunia, Former Director NIT, Arunachal Pradesh and Director General of DIATM, DIP & GDPITI as Chief Guest, Dr P K Chatterjee, Chief Scientist, CSIR-CMERI Durgapur as Guest of Honour, Dr P K Sinha, Principal, DIATM Rajbandh as Guest of Honour, Dr A K Das, Dean of Academic, DIATM as Guest of Honour and Dr Bikash Ghoshal HOD Mechanical, DIATM as Guest Speaker. Mr R K Roy as Chairman, IEI, Durgapur Local Centre and Mr. M N Bandyopadhyay as Hony. Secretary, IEI, Durgapur Local Centre.

The seminar started with a welcome address by Chairman, Mr R K Roy. In his address he highlighted the theme of the seminar and said that as industry has grown and taken an increasingly large role on the global scene, the relationship between industry and those who try to address the side effects from industry on the environment has been one of constant change, of push and pull. Historically, it has usually taken some time before we can really realize the specific damage that certain technologies can cause. This means that there is often a significant amount of damage done before policy can catch up. A large and growing number of manufacturers are realizing substantial financial and environmental benefits from sustainable business practices. Sustainable manufacturing is the creation of manufactured products through economically-sound processes that minimize negative environmental impacts while conserving energy and natural resources. Sustainable manufacturing also enhances employee, community and product safety.

Before starting of main programme short films were also shown on the theme.

Chief Guest, Dr C T Bhunia in his address said about the manufacturing entrepreneurship. He discussed about the technologies which are sustainable and hazard free. He told that innovation is required for sustainable manufacturing process. In his discussion he gave example of refrigerator run by solar power and using of computer by solar power apart from example of electric vehicle. He Added that to address sustainability in a coordinated, integrated and formal manner, rather than in an ad hoc, unconnected and informal manner it may be focused on increased competitiveness and revenues rather than primarily focusing on cost-cutting, risk reduction and improved efficiency & use innovation, scenario planning and strategic analysis to go beyond compliance. He concluded by saying that integrate sustainability across business functions with a focus more on the long term and work collaboratively with external stakeholders

with an increase of Increased operational efficiency by reducing costs and waste.

Guest of Honour, Dr P K Chatterjee deliberated on waste management from the produce of manufacturing process. He started with explanation of wastes which are substances or objects, which are disposed of or are required to be disposed of by the provision of law. Normally these wastes are generated during processing of any raw material to a finished product. Waste management is a part of manufacturing process. He intimated that One of the major impacts of production that often seems invisible to many in wealthier nations is the extreme damage done to those living in developing countries. Because health and safety standards are often much lower in developing countries, and enforcement is often lax at best, significant environmental damage can pile up in these countries, especially when manufacturers choose to outsource production to these locations because with low health rates comes low production costs. He mentioned that Environmental consciousness and recycling regulations are putting pressure on both manufacturers and consumers, forcing them to produce, use and dispose of products in a responsible manner. This has led to a need for models, algorithms and software to create new designs and also to address the logistics involved in support and remanufacturing, recycling and disassembly for an ever-increasing number of discarded products. He told that For environmentally conscious manufacturing to take effect there must be a shift from the traditional paradigm. Up to now, the focus has been on building reliable, cost-effective quality products.
But as manufacturers are starting to focus on methods to support, recover, disassemble, and reuse materials, the management of a product's life cycle becomes a key issue and known as product stewardship, this concept represents a system & product stewardship assures the following

- Evaluation of product design, material selection and support for environmentally conscious manufacturing. Ease of maintenance and recycling.
- Ease of support and disassembly. Effectiveness of waste collection systems.
- Safe disposal of hazardous wastes.
- Environmental impact assessment of manufacturing and maintenance processes.
- Economics of support and recycling.

He concluded with the points mentioning that Manufacturing operations and the natural environment are becoming increasingly linked. To incorporate a measure of environmental impact in manufacturing strategies, expressions for assessing the environmental impact (EI) on society can be used. One common expression for the environmental impact on society is $EI = P \times A \times T$, where P, A and T denote population, affluence and technology respectively. Population is difficult to constrain and affluence is increasingly sought by people. Thus, technology, which can be defined as the knowledge of an organization, is the factor that can be improved to reduce environmental impact. The technology category relating to the environment and manufacturing is affected by the product, process and practices.

Guest of Honour, Dr A K Das deliberated upon water in manufacturing process and treatment, recycle of same. He gave example of thermal power plant. He explained how untreated water can cause damage to the equipment by producing salt deposition and ultimately generated waste by damaging the equipments. He explained with a case study of a thermal power plant and described the methods of controlling corrosion, scale formation, methods of purification and testing methods. Water treatment system is applied. He told that generally treated water used in
1. Heating Plants, Heat and power plants ,Combined Cycle Power Plant (CCPP) composed of: Gas Turbine with combustion and expansion of burnt gas
2Heat Recovery Steam Generator (HRST operating up to 700 °C) with steam Turbine (ST)
3. Nuclear power stations with steam generators operating with:
Now well designed water treatment program can significantly reduce energy, water, and maintenance costs while ensuring safe and reliable operation.
Small reductions in boiler or chiller efficiency - huge increases in operating costs.
Example:

- mere 0.8 mm of scale in a 15 tons steam/hr boiler can increase annual fuel costs by over Rs 50 lakhs

- mere 0.1 mm of microbiological fouling in a 3500kW chiller can increase annual electricity costs by Rs 30 lakhs!

He explained the steps of water treatment which are i) chemical support for magnetite or other oxide protective coating formation ii) pH optimation for protection of materials against various types of corosion iii) stabile hardness and reduced scale deposits formation iv) chemical fixation of residual oxigen v) special coatings formation for metal surfaces protection
He mentioned that normally chemicals used for the water treatment are i) sodium hydroxide ii) potassium hydroxide iii) sodium phosphate iv) sodium sulfide v) ammonia and vi) hydrazine etc.
Task of feed water pretreatment is to eliminatea) Suspended parts ,Solid substances,Coloids – substances of variable size,variable charge
Methods of pretretment are i)Direct separation – sedimentation, filtration, ultrafiltration or microfiltration ii) Coagulation and separation – ultrafiltration, nanofiltration or reverse osmosis iii) Clarification (coagulation + flocculation -sedimantation) – acid, neutral and alcalic
He explained the process of clarification [coagulation ,flocculation ,sedimentation (filtration)] & different techniques which are Acidic clarification, Neutral clarification & Alkaline clarification
He concluded with the remarks that though untreated water causes scaling and corrosion and generated junk and waste, by understanding water characteristics and treating the same will prevent junk generation and a healthy, green manufacturing process.

Guest of Honour, Dr P K Sinha discussed about diffuser which is "a device for reducing the velocity and increasing the static pressure of a fluid passing through a system". Diffusers are used to slow the fluid's velocity while increasing its static pressure. The fluid's static pressure rise as it passes though a duct is commonly referred to as pressure recovery. In contrast, a nozzle is often intended to increase the discharge velocity and lower pressure while directing the flow in one particular direction.
He experimented with C Shaped sub sonic diffuser which is [At subsonic speeds (Ma<1) a decrease in area increases the speed of flow. A subsonic nozzle should have a convergent profile and a subsonic diffuser should possess a divergent profile. The flow behaviour in the regime of Ma<1 is therefore qualitatively the same as in incompressible flows] and discussed about his experiments.
In many engineering applications, diffusers are used to convert the dynamic pressure into static pressure. The importance of the diffuser as a single, useful, fluids handling element in wind tunnels, turbo-machinery, and as interconnecting flow passage between the components of gas turbines has been widely known. Understanding of diffuser flows, therefore, is of paramount importance to the design of fluid-flow systems. Diffusers are designed in different shapes and sizes to meet the specific application. Curved diffusers of different centre line shapes find wide uses in the field of aircraft applications to satisfy design compatibility and space restrictions. Flow characteristics in curved diffusers are most complicated due to the influence of centerline curvature, different geometrical parameters like total angle of divergence (2θ), angle of turn ($\Delta\beta$), area ratio (AR), inlet aspect ratio (AS), centerline shape, etc. as well as the dynamical parameters like inlet Reynolds number, inlet turbulence, etc. In curved channels the radial pressure gradient, resulting from the centrifugal force acting on the fluid due to the centerline curvature, can produce significant secondary flows. In addition, the adverse stream wise pressure gradient, resulting from the diverging flow passage of curved diffusers, can lead to flow separation. The combined effect may result in non-uniformity of total pressure and total pressure loss at diffuser exit, thus affecting the diffuser performance.
He told that frictional effects during analysis can sometimes be important, but usually they are neglected. Ducts containing fluids flowing at low velocity can usually be analyzed using Bernoulli's principle. Analyzing ducts flowing at higher velocities with mach numbers in excess of 0.3 usually require Compressible flow relations.
A typical, subsonic diffuser is a duct that increases in size in the direction of flow. As the duct increases in size, fluid velocity decreases, and static pressure rises. Both mass flow rate and Bernoulli's principle are responsible for these changes in pressure, and velocity.
He told that after experiment on a C-Shape Subsonic Diffuser he concluded that High velocity fluids shifted and accumulated at the concave wall of the exit section.

• The mass average static pressure recovery and total pressure loss for the curved test diffuser is continuous from Inlet section to Section C.
• Performance parameter like coefficient of mass average static pressure recovery and coefficient of mass average total pressure loss are 47% and 10% respectively.
• A comparison between the experimental and predicated results for the annular curved diffuser show good qualitative agreement between the two.

Guest Speaker, Dr Bikash Ghoshal discussed about micro machining and applications. He told that It is widely agreed that the development of micromachining technologies are necessary to meet the demand of micro-technology based products like printed circuit board, micro sensors, chemical micro-reactors, microchip, switches, stress free cooling micro holes in aerospace industry, micro fuel injection nozzles in automobile engines for fine spray of fuels, biomedical systems, micro-fluidic systems and micro-electromechanical systems (MEMS) etc. Micromachining technology has become popular due to recent trend in societies to have micro products in narrow space to accommodate huge human populations. Micromachining technologies are also useful in saving material, energy catering to the needs of micro products with enhanced functionalities. High aspect ratio micro features may have application in high volume flow in micro reactors, micro-fluidic devices, high capacity microelectronic cooling, inkjet printers etc. Fabrication of high aspect ratio micro-features have been reported by electro discharge machining (EDM), electron beam machining (EBM), and laser beam machining (LBM) but these are based on thermal energy and hence, heat affected zone, micro cracks, residual stresses in the work piece are common disadvantages in addition to process specific limitations. Electrochemical micromachining (EMM) is gaining importance as a micromachining technology due to specific advantages like no residual stress, no heat affected zone, no tool wear, ability to machine complex shapes irrespective of hardness, high material removal rate (MRR), better surface finish and no burr etc. Process control strategy of EMM needs knowledge in electrical, chemical, thermal, hydrodynamic phenomena and electronics instrumentation.
Micro-manufacturing emerged in a new engineering area with the potential of increasing peoples' quality of life through the production of innovative micro-devices to be used, for example, in the biomedical, micro-electronics or telecommunication sectors. The possibility to decrease the energy consumption makes the micro-manufacturing extremely appealing in terms of environmental protection. However, despite this common belief that the micro-scale implies a higher sustainability compared to traditional manufacturing processes, recent research shows that some factors can make micro-manufacturing processes not as sustainable as expected. In particular, the use of rare raw materials and the need of higher purity of processes, to preserve product quality and manufacturing equipment, can be a source for additional environmental burden and process costs. Consequently, research is needed to optimize micro-manufacturing processes in order to guarantee the minimum consumption of raw materials, consumables and energy. In this paper, the experimental results obtained by the micro-electrical discharge machining (micro-EDM) of micro-channels made on Ni–Cr–Mo steel is reported. The aim of such investigation is to shed a light on the relation and dependence between the material removal process, identified in the evaluation of material removal rate (MRR) and tool wear ratio (TWR), and some of the most important technological parameters (*i.e.*, open voltage, discharge current, pulse width and frequency), in order to experimentally quantify the material waste produced and optimize the technological process in order to decrease it.He concluded with the remarks that process optimization in micro-manufacturing is essential to guarantee the sustainable development of innovative micro-technologies. The use of high added-value raw materials and the need of a cleaner working space to preserve products' quality and machinery performance can in fact represent important sources of additional costs and negative environmental impacts. This is especially true in Micro-EDM machining, which is one of the most energy-intensive micro-process and which may require considerable consumption of rare materials.

Prof H B Goswami, Council Member, IEI summarized the sessions and lectures and gave his own views with his vast experience of Durgapur Steel Plant. He described a case study of Steel plant. He mentioned that during manufacturing at CEM/ERS or during production process lot of wastes generated. The wastes thus generated tackled in various ways including reuse and recycling. One example is slag of Durgapur

Steel plant is used by Durgapur cement works to produce cement. A detailed study states that Clean Technology Measures for a sustainable production process and manufacturing for a steel plant requires Castable runners installation in Blast Furnaces, processing of the waste containing flux & ferrous waste through waste recycling plant **,**BOF Slag use in BF, BOF, SP, Foundry and mill scales, lime fines use for sinter making. Scrap use as charge in Blast Furnace and BOF, reduction of Green House Gases**,** use of by-product gases for power generation and continuous efforts are required for reducing power consumption, resource conservation etc.

The program ended with a lively discussion on the issues raised by the eminent speakers. Mr. M N Bandyopadhyay, Honorary Secretary, Durgapur Local Centre delivered the Vote of thanks & expressed his hope that such seminars would be organized on a regular basis & ensure the participation of greater numbers of members in such events.