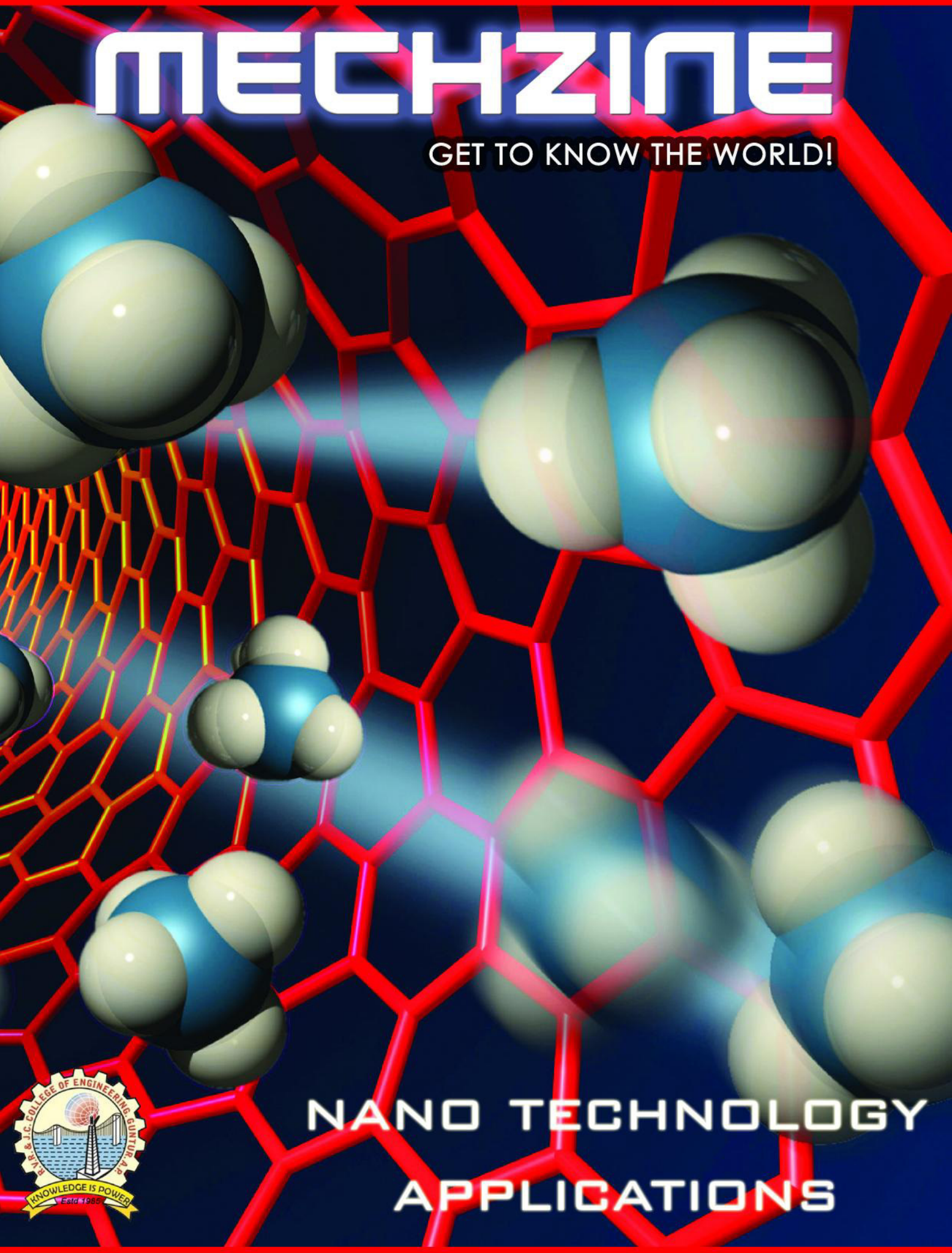
Vol 1 | Issue 2 | July 2016

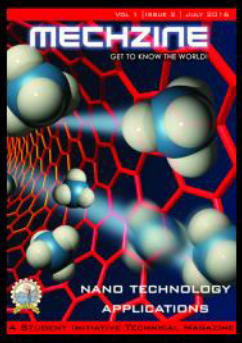
MECHZINE

GET TO KNOW THE WORLD!



NANO TECHNOLOGY APPLICATIONS

A Student Initiative Technical Magazine



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Contact Information
Mail us at
rvrmechzine@gmail.com
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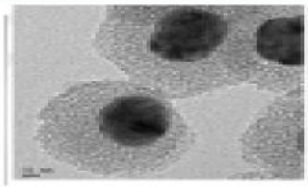
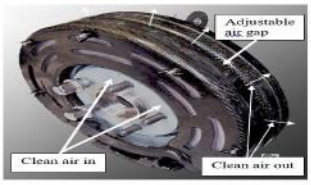
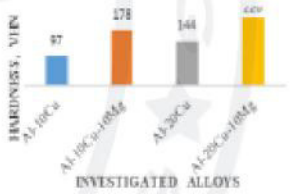
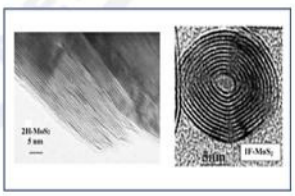








Digital Product, Automation and Control ERA – Current Challenges

Mr. G. Venkatesvarlu
Vice President, Axiscades

Background:
Now a days if one goes through the news (Papers, Journals or web), the buzz word is Automation, Industrial Internet of things and their effects on the technology and the work force. As per popular estimations, Automation is most likely to eliminate 60% of the work force requirements for the future. However adoption of these new technologies is most likely to create 30% additional jobs for candidates who have the skills. Automation era would mostly likely be responsible for 65% work force at Middle Senior Management Level to lose their jobs in the next 4-5 years, if not in the next decade.

Digital Product: Gone are the days where a Mechanical engineer would need to toil on the drawing board to develop a new design or rush to archives (Ammonia prints) to retrieve an old design and adopt it after suitable modifications.With the latest available commercial tools and technology, one can create a design on the computer (Inventor, Creo,UG-NX, Catia etc..), review its features, calculate its weight/Cost (Costimator/DFMA), Validate the design performance for intended use (ADAMS, MSC/Nastran, Abaqus, Ansys etc…), Check the manufacturing feasibility (Moldflow, AutoForm, PamStamp etc..) and also develop associated manufacturing facilities (Delmia, Siemens Technomatics etc..). All of this means, a product can be fully developed, visualized and tested, even before it can be manufactured. The old designs also can be archived and retrieved digitally with version controls (PLM tools such as Team Center, Enovia etc..)

Automation and Controls: Gone are the days where any of the industrial processes and machines are controlled using traditional Mechanical Linkages and Governors. As a result, the traditional kinematics based designs are fast becoming obsolete and giving way to mechatronics based design and most sophisticated electronic sensor based controls.

IIOT: IIOT stands for Industrial Internet of things. This technology enables measuring performance of status of any machine or process from a remote location and obtain the data over Internet.

Challenges and Work Around: Under the current circumstances one cannot limit himself to his area of education/operation. One has to constantly update himself about the latest trends and advances in technology, even in other disciplines. Also in the current situation, it is no more an individually/independently isolated technology game and has to be a team play. Moving forward to accomplish any task, it has to be a multi-disciplinary team drawn with expertise from all branches/streams of Engineering. There shall be no independent existence and one has to be a team player, be aware of the requirements from other fields and collaborate. One final word of caution as the trends get more and more closer to automation, the reliance on the tools (Software and Hardware) shall increase rapidly. But all said and done, tools are tools and they have only programmed intelligence. They take in some input and give some output (GiGo – Garbage-in and Garbage-out). ttHence a clean understanding of the fundamental principles of Engineering which is acquired during the education is of paramount importance to understand the underlying principles of operation of these tools. To put it in simpler terms, tools are like a paint brush in the hands of an artist which cannot generate a painting on its own. It all depends on the talent of artist to generate a painting and not the brush. Similarly an Engineer who is proficient in tools but not with engineering fundamentals cannot achieve anything. It is easy to train a person good at Engineering with the tools. But the Vice Versa is not possible.

To summarize, one has to master the fundamentals of Engineering, be aware of the trends in other fields and then get himself familiarized with the latest tools. Besides, he has to be a good Team Player.

COATING ON PARTICLES FOR IMPROVED WETTABILITY IN COMPOSITES

Sri D. Sameer Kumar
Assistant Professor

Purpose :

The properties of any composite always depend on the bonding between the matrix and reinforcement phases. One way of improving the wettability of reinforcement in matrix is to apply a layer of coating on reinforcement particles. The present information aims at the development of Ni coating on nano Al_2O_3 ceramic particles The Electro less plating method has been employed to coat the particles.

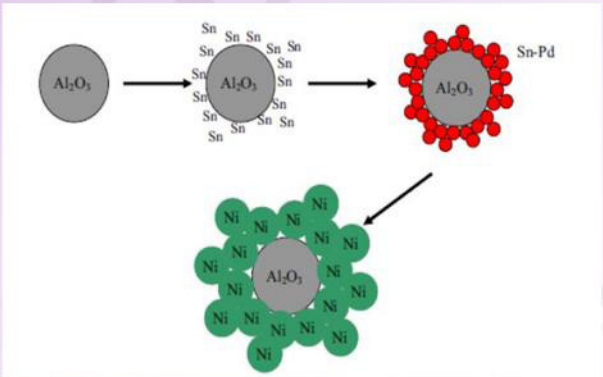


Fig 1 The Schematic diagram indicating the Ni plating process with $SnCl_2$ sensitization and $PdCl_2$ activation

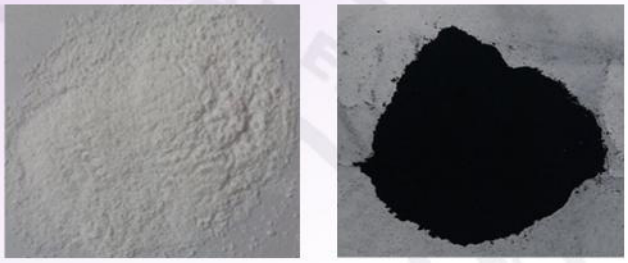
Methodology :

The 99 % pure AL_2O_3 powders with an average particle size of 50 nm is considered. Electro less plating technique is used to coat Ni on the surface of these particles.

The Electroless process completely depends up on catalytic reduction of metallic ion in an aqueous solution containing reducing agent. In this experiment, Nickel Chloride Hexahydrate ($NiCl_2.6H_2O$) is used as a source of Nickel ions while Sodium hypophosphite ($NaH_2PO_2.H_2O$) is used as the reducing agent. At first, the powders are pre-treated with various chemicals. The mechanism of coating is explained in fig 1. Further details can be looked up in the references provided.

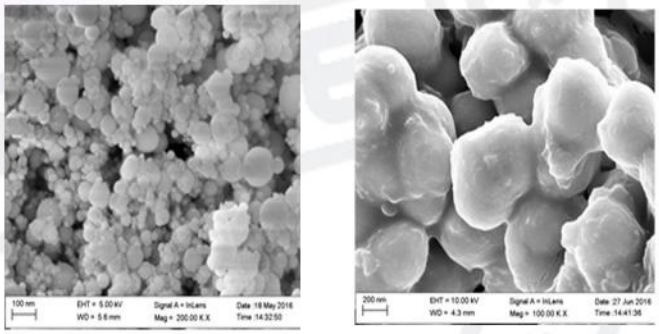
Results :

The Color of pure Al2O3 is initially white while the color of Ni coated Al2O3 ¬ is black Fig 2. The color change is a good indication of effective plating . In addition to color change, the density of pure α-Al2O3 is 3.90 g/cm3 while the density Ni coated powder is 4.15 g/cm3 respectively. The increased density of the particle is due to the presence of metallic Nickel over the surface of alumina. The FESEM , TEM Images were presented here to impart the Quality of Coating



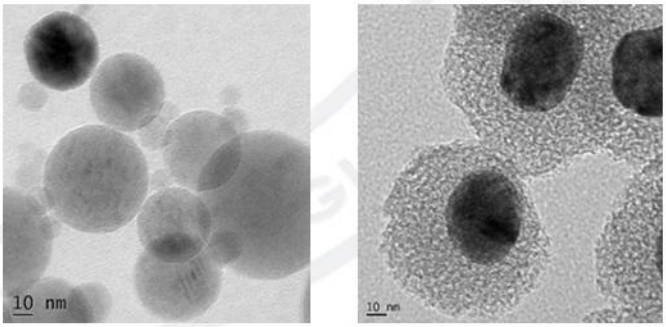
(a) α-Al_2O_3 Powder *(b) Ni coated Powder*

Fig 2 Photographs of Al_2O_3 powders before and after coating



(a) *(b)*

Fig 3. FESEM images of (a) Un coated and (b) coated α-Al_2O_3 Powders



(a) α-Al_2O_3 Powder *(b) Ni coated Powder*

References:

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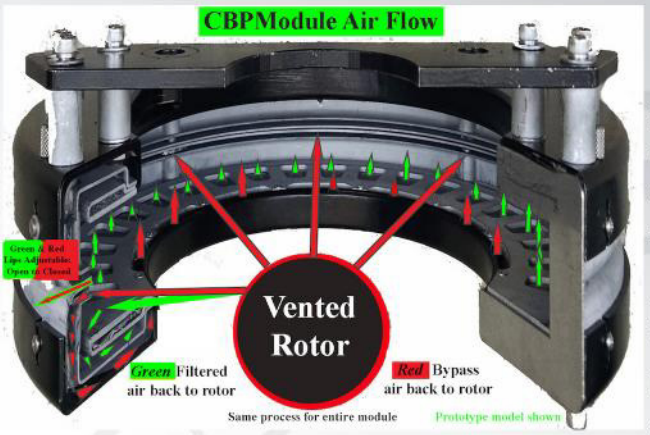
no. 2, (2016) April, pp. 177-186.

BRAKE CLEANING IS REALLY ESSENTIAL!

Courtesy - Joe Gelb

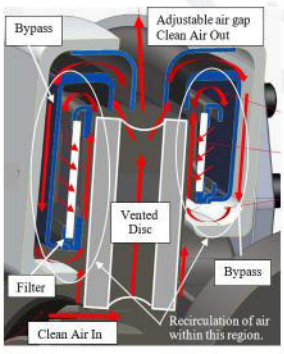


Currently there are over 1.25 billion units on the road (0.32 billion in the USA), a minimum of 5 billion brakes or 10 billion pads. In addition the industry manufactures around 90 million units per year which represents around 400 million brakes. All these deposit debris to the surroundings. The vehicle numbers represent the market potential for this design.

Dust is an environmental and health concern. The "Brake Pad Partnership" concluded that some 50% of brake dust becomes airborne and estimated that 580 tons of copper/year finds its way into California waterways - recommending "source control" rather than water treatment. European research estimates that brake wear will contribute up to 55% of non-exhaust air pollution from vehicles. The particle sizes less than 2.5nm penetrate deep into the lungs and international research concludes "the identified compounds are known to have adverse effects even with mutagenic and carcinogenic potency to humans."

The proposal of "source control" has seen significant R&D devoted to copper free pads - significant time and money in order to satisfy this legislation demand. The alternative to "source control" is to "collect at source."

No viable or cost effective on-vehicle dust collection system exists on the market. The Clean Brake Performance Module (CBPM), designed by Joe Gelb, is the only cost effective on-vehicle dust collection system that may be readily fitted to any vehicle. It embraces the entirety of the brake, has no moving parts and absorbs no power. Clean air flows into the disc vents and flows radially outwards. At the disc rim the module employs 2 lipped members to "tap-off" an amount of the airflow dictated by the degree of lip overhang into the vent outlet area. It is then directed into a bypass channel formed by the module outer casing to an outer high pressure region. The air then flows downwards to a low pressure region and back towards the disc surface where it "scrubs" the disc surface of dust as it is driven outwards to the rim of the disc. At this point a second lip guides the total airflow into a filter channel forcing it through the filters and back towards the disc surface. The air is thus constantly recycled and filtered. Once the recycling process has been established (whenever the wheel is rotating) the majority of air will pass through the disc vent so maximizing cooling.



Independent first prototype testing by LINK Engineering showed dust collection to be 92% by weight. In addition it was seen that disc thickness wear was reduced by 58%, inner pad by 17% and outer pad by 29%. It was also seen that over the majority of test cycles the brake temperature was reduced. The added advantage of a totally enclosed brake is that it reduces the effects of NVH as it inherently acts as a noise barrier.

The outer casing may be personalized to emphasize the character of the vehicle - constructed from carbon fiber, glass fiber, pressed brushed stainless steel or anodized aluminum alloy.

NANO PARTICLE BIO-MARKER TAGGING

Courtesy - Wesley Baker

Ancon Medical has developed a non-evasive disruptive early stage screening and disease detection device that is "once in a generation technology" known as Nanoparticle Bio-marker Tagging (NBT). NBT will have a similar impact to market as MRI and X-Ray and will use breath screening and detection through VOC Bio-marker Identification. However, we can expand this with ease for screening of any disease that has volatile or semi volatile Bio-Marker signatures. Furthermore, our technology opens the doors for building a world comprehensive bio-marker library.

The NBT offers a revolutionary means of detecting trace chemicals in the air, at the level of single molecules (bio-markers) and is applying the same technology that already has a successful history and track record for other industries including homeland security, military detection, workplace environmental monitoring, and bio-hazards. Sensitivity is orders of magnitude superior to ALL existing state of the art technologies and is at ultimate physical sensitivity level.

This ground breaking NBT technology has been developed to enable real-time measurement of specific bio-markers allowing for early stage screening and future diagnosis of diseases including Lung Cancer, Tuberculosis, and a range of other cancers, and infectious diseases such are Ebola possible.

NBT works by selecting bio-markers of target substances from complex chemical backgrounds present in normal atmospheres (such as exhaled breath) and tagging them with specially generated proprietary Nano-objects. Tagged molecules are individually counted with laser counters. This is a uniquely novel approach to measuring the numbers of molecules or bio-marker present in a sample and is the basis of NBTs unprecedented sensitivity!

In developing the Healthcare business, Ancon Medical will focus first on applications with a recognized need which cannot be met through existing technologies. As the Company matures, opportunities will be pursued in numerous additional applications, including drug development and other life science applications.
The NBT screening and diagnosis systems will be in every clinic, hospital and public health setting providing real time early stage screening and diagnosis for cancers and other diseases. It will enable personalized treatments whose effectiveness can be monitored frequently. Early stage diagnosis and effective treatments will save lives, improve quality of life and reduce cost of long term care.

The ability to select specific target molecules and bio-markers and measure their concentration at unprecedentedly low levels means NBT has many potential applications, such as to help clinicians to screen and diagnose the very early stages of cancers and other diseases at point of care in real time. It allows Doctors to personalize treatments and patients to monitor their effectiveness frequently and inexpensively. It offers research capability to discover and build a large bio-marker library and helps towards new drug development acceleration and treatments monitoring.

Imagine visiting the Doctors and just breathing into a device and in 3 minutes having the results through a non-evasive method and being able to manage an illness daily through this method.

GATE

Graduate Aptitude Test in Engineering:

It is an all India examination administered and conducted jointly by Indian Institute of Science & Indian Institute of Technology.

Gate has become online and is conducted during January to February every year.

Candidates need to apply online for the examination.

NUMBER OF ATTEMPTS: NO RESTRICTION
GATE SCORE VALIDITY: 3 YEARS
AGE LIMIT: NONE

ELIGIBILITY:

Bachelor's degree holders in Engineering/Technology/Architecture(4 years after 10+2) and who are in the final year of such programmes.

Master's degree holders in any branch of Science/Mathematics/Statistics Computer Applications or equivalent and those who are in final year of such programmes.

NOTE: PRE-FINAL YEAR STUDENTS ARE NOT ELIGIBLE TO WRITE GATE

GATE EXAM PATTERN:

GATE EXAM
Questions:65
Marks:100
Duration:3hrs

SUBJECTS
Engineering Mathematics:13-15 Marks
General Aptitude:15 Marks
Core Questions: 70-72 Marks

QUESTION TYPES
Multiple Choice Questions:32-46
Numerical Answer Questions:19-33

DIVISION OF MARKS
Number of 1 mark questions:30
Number of 2 mark questions:35

*NEGATIVE MARKING 33% ONLY FOR MCQ'S

GATE QUALIFYING CUTOFF SCORE

Private Colleges: <35
Private Sector(Core Companies): 35-75
Central University: 35-75
NIT: 45-75
IIM(FPM): 55-75
NITIE MBA: 55-75
Education Abroad: 55-75
PSU: 55-75
IITs: 65-75

WHY GATE

ME, M.TECH, MS & PHD
IISc, IITs, NITs, Central University, Govt. Colleges, Private Colleges accept GATE score for their ME, M.TECH, MS & PHD programs.

PSU DIRECT CALL
43 Public Sector Companies are recruiting via GATE. PSUs recruiting Mechanical Engineering students are IOCL, NTPC, BHEL, NHPC, BPCL, HPCL, GAIL, NLC, MECON, CONCOR, MECL, NALCO, DDA, BEL, etc.

STUDY ABROAD
NUS,NTU Singapore accept GATE Score. Aachen University Germanyaccepts GATE Score. (Best known for Mechanical and Automobile Engineering) Technical University of Munich accepts GATE Score. GATE qualified students also get a handsome scholarship Abroad.

FABRICATION AND CHARACTERIZATION OF HIGH STRENGTH POLYMER MATRIX COMPOSITES REINFORCED WITH METALLIC GLASS PARTICULATES

B.Sandeep
Y14MTMD804

Presently composite materials are playing a pivotal role in manufacturing of various automobile and engineering components because of their novel properties like high strength to weight ratio, corrosion resistance, specific strength characteristics, ease of manufacturing, low production cost and excellent specific modulus.

In this study, metallic glass particles reinforced epoxy resin composites were fabricated to investigate the characteristics of ACAMOLON 4413. Metallic glass particles were added in the epoxy resin as reinforcement with various weight fractions varying between 2 % and 10 % with an increment of 2%.The tensile strength, compressive strength, flexural strength and vicker's hardness were evaluated and compared. The particle distribution was investigated under scanning electron microscope and optical microscope. The results indicate that the tensile strength and specific hardness were gradually reduced with the increase of filler content. The hardness, compressive strength and flexural strength increased with an increase of weight fraction of metallic glass particulates.

Reinforcement selection & Hardness studies

The prime idea of fabrication for a strong and wear resistant reinforcement, needs to be investigated for composite preparation. A series of alloys have been prepared and investigated for suitability as reinforcement.

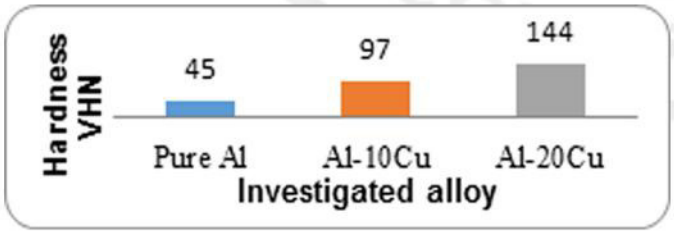


Figure 1. Effect of copper contnent in Al-Cu binary system

In order to achieve higher hardness values, Initial trails with binary alloys have shown increase in hardness from 45 to 143 VHN, figure 1.

Ternary alloy systems have been tried with 10% magnesium content. Al-20Cu with 10Mg have shown further increase in hardness from 97 and 220 VHN figure 2. Hence Al-20Cu-10Mg has been adapted.

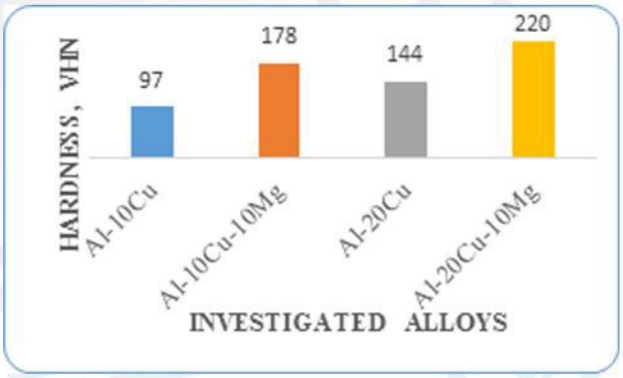


Figure 2. Effect of magensium content in Al-10Cu, Al-20Cu- Mg ternary system

Looking at the advantages in terms of hardness and density, Al-20Cu-10Mg alloy has been used as the reinforcement in the present investigation.

RESULTS AND DISCUSSION

- EDS pattern has no oxygen peaks i.e metallic glass particles are not contaminated.
- Microstructure of the composites is showing uniform particle distribution at lower percentage of reinforcement content and showing agglomeration at higher percentage of particle distribution.
- Tensile strength of composites decreased with increase in the reinforcement.
- Hardness, Density, Compressive strength, Flexural strength, Load bearing capacity of composites increased with increase in the reinforcement content.

Ignored Request

Harish Chaitanya

Hello readers I am environment (environ – for short), I live around you. I wonder if there is anyone who is going to read this article as I know that you people are too busy to read newspapers and magazines. With that in mind I want to approach you people personally. But girls accounts were kept private and boys will accept the request as if it was a girl. This turned me to check out my luck and I was here now in this column penning down some of my emotions.

Coming to the point I plead you people to save me because I am affected with high fever during summer as my body temperature is rising above the alarm levels. During winter, my body temperature falls down and I have a running nose. There is no doctor who is interested in healing me, instead they are using more pesticides that ruin my health and no Engineer feels pity for me. Furthermore you have started looting all my wealth that was stored in my savings account for your future needs. You people feel that you stay comfortable inside your room, irrespective of the weather outside by turning on your air conditioners, heat pumps, refrigerators etc., which will release harmful gases that affect only me directly, but not you, so you will never look after my troubles. After completely utilizing my resources now, you are going to leave me in search of new compatible place to live on. It seems like you are going to exploit my siblings now. Please people, I love you a lot say for approximately some million years now and after. So, please don't abandon me. Instead cure me by planting more trees and utilizing my sources in meager amounts that will give you a sufficient rainfall and will yield you an adequate amount in return. I will make you stay comfortable in natural habitat and you would enjoy my cool breezes. My showers will refresh you.

So, this is my humble request not to ignore me.

Yours lovingly,

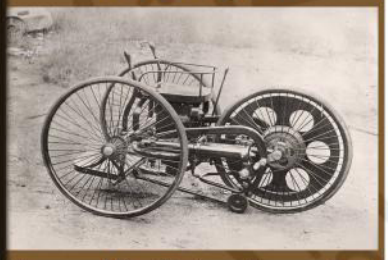
Environ.

BHARATHA "RATHNA"

G. Narayana Ramachandran

Gopalasamudrum Narayana Ramachandran was born on October 8, 1922 at Ernakulam in Kerala. He did his B.Sc., M.Sc. from Madras University, and D.Sc. from IISc Bangalore. He completed his postdoctoral research at the University of Cambridge. Ramachandran has been one of the innovators in the field of applications of physio-chemical ideas and techniques for the analysis of bimolecular structure and explanation of biological activity in terms of structure and conformation of the constituent chemical molecules. For the purpose of research on X-ray crystallography, he set up an active school. He was also the editor of 'Current Science' apart from being a member of the Editorial Board of a number of journals.

World's First Motorcycle

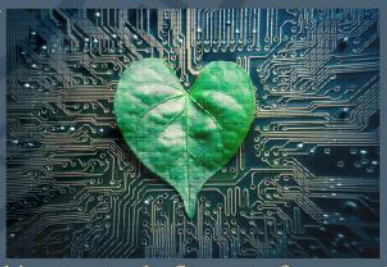


The world's first motor cycle is called the "Butler Petrol Cycle" , it was invented built by Edward Butler in England in1884. It was powered by a 5/8hp, 600cc twin-cylinder four stroke engine, with rotary valves, a float-fed carburettor and Ackermann steering. The Butler Petrol Cycle is a rear-wheel drive, interestingly its inventor didn't see the need for brakes and so he didn't fit any. Forward motion was stopped by raising the driven wheel off the ground via a foot-lever, transferring the weight to two castor wheelson either side. Whilst some consider Butler's invention both the first car and motorcycle, it is generally agreed that it is the first motor cycle

TREE ON A CHIP

M.Viswanadha Reddy
Y14ME392

Microfluidic device generates passive hydraulic power which can be used to make small robots to move. Trees and other plants, from towering redwoods to diminutive daisies,natures' hydraulic pumps. They are constantly pulling water up from their roots to the topmost leaves, and pumping sugars produced by their leaves back down to the roots. This constant stream of nutrients is shuttled through a system of tissues called Xylem and Phloem, which are packed together in woody, parallel conduits.



Now engineers at MIT and their collaborators have designed a microfluidic device, which they call as "tree-on-a-chip," which mimics the pumping mechanism of trees and plants. Like its natural counterparts, the chip operates passively, requiring no moving parts or external pumps. It is able to pump water and sugars through the chip at a steady flow rate for several days. The results were published in the Nature Plants.

Anette "Peko" Hosoi, professor and associate department head for operations in MIT's Department of Mechanical Engineering, says the chip's passive pumping may be leveraged as a simple hydraulic actuator for small robots. Engineers have found it difficult and expensive to make tiny, movable parts and pumps to power complex movements in small robots. The team's new pumping mechanism may enable robots whose motions are propelled by inexpensive, sugar-powered pumps.

"The goal of this work is cheap complexity, like one sees in nature," Hosoi says. "It's easy to add another leaf or Xylem channel in a tree. In small robotics, everything is hard, from manufacturing, to integration, to actuation. If we could make the building blocks that enable cheap complexity, that would be super exciting. I think these [microfluidic pumps] are a step in that direction."

NANOMATERIALS FOR GEAR LUBRICATION

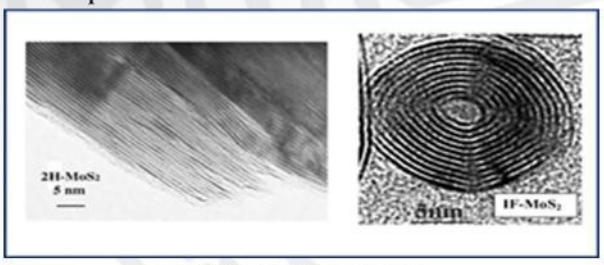
K. Sai Rohith
Y14ME876

Introduction

The increased interest in nanotechnology appeared at the end of 20th century based on significant alteration of fundamental physical and chemical properties of conventional materials with reduction of their size to the Nano-scale. The Nano-scale particles, due to their greatly reduced size, exhibit properties that are not obtainable with large grain structure.

Lubrication solutions

A new product called NanoLub, is being used as a performance enhancing additive to gear lubrication for extended lifetimes, lower operating cost, and improved power efficiency. The product is based on inorganic WS_2 fullerene-like Nano particles, which is formulated either as oil concentrate or paste, and has been developed to improve lubrication properties of oil and greases by decreasing friction and wear. Numerous laboratory investigations and industrial experience indicate that using NanoLub has significant advantages when compared to conventional solid lubricants in both mild and extreme pressure conditions.

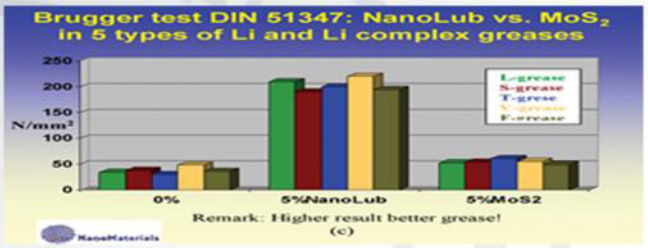


SEM Images of NanoLub

Tungsten-di-sulfide (WS_2) and Molybdenum-di-sulfide (MoS_2) are well known solid lubricants that are very similar in their properties, and they naturally appear in the shape of platelets of 1-15 microns in size. Their tribological properties are based on their layered structure, whereby friction is reduced by a mechanism based on sliding action between alternating Molybdenum or Tungsten Sulfide layers that exist in the interface of rubbing surfaces.

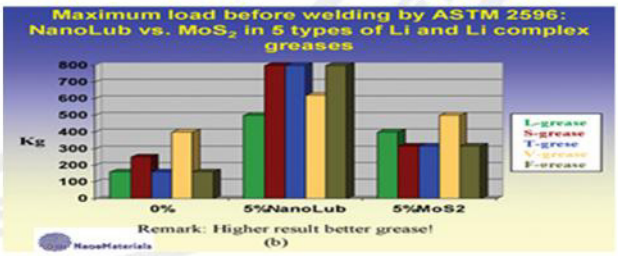
To prepare NanoLub, different formulations with oils and greases in the form of concentrates and pastes were developed. It has been shown that NanoLub has advantages in the following fields:

- Ensure the greater engine and gear life due to wear reduction by reducing friction.
- Increase power efficiency in engines and gears.
- Reduce noise and vibrations.
- Reduce engine oil consumption.
- Increase the interval between oil and grease changes.



Nanomaterials, today, have their main effort in synthesizing Nano-powders and formulating them into lube additives as concentrates for oils and pastes for greases. These concentrates are added to the engine or gear oil, or to the based grease at treat rates that achieve 0.5-5 percent of powder in the final oil or grease suitable for direct use.

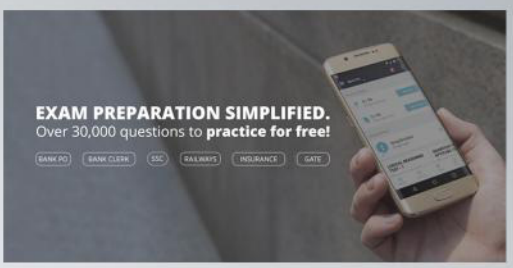
The tribological properties of the oils and grease mixed with NanoLub were investigated in nanomaterials laboratory and by independent parties using a number of standard tribological tests. Physical properties of grease were tested, and standard protocols for evaluating corrosion resistance were employed. Some of results obtained during investigations of NanoLub performance as a solid additive in different gear oils and grease



Conclusion:

The results show the significant increases in the operational life of rolling/sliding components (engines, gears etc.) can be achieved by using lubricants incorporating inorganic fullerene-like materials in specially chosen formulations. The successful performance achieved with the lubricant containing if-WS2 is due to their Nano-size, spherical shape, and tribofilm which is obtained on the running surface.

TRENDING APPS



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FUN ZONE

MIRROR IS NOT PERFECT

I found my reflection as shown in the fig. above. Please help me to find my height

An addiction to distraction is the end of your creative production
-Robin Sharma

58^2=?

Step 1: Add 25 to the ones digit
25+8=33

MATH TRICK

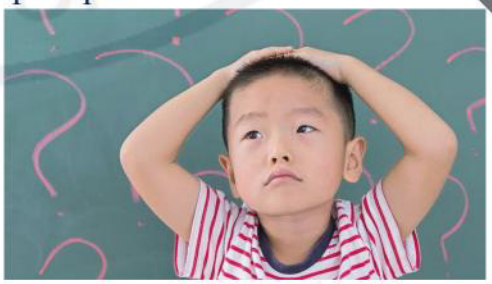
Step2:
Square the ones digit
8x8=64

Step 3:
Put them together to get the answer
58^2=3364

FUN ZONE

Shopkeeper cheated me!

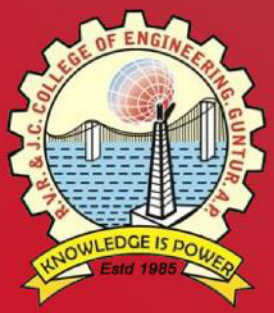
I am Ramu. My age is 5 years. I love eating snickers. So yesterday I went to a shop to by snickers. Suprisingly there was an offer on snickers that if I buy them and give 3 wrappers back I get one more. So I bought 15 snickers. Please tell me how many chocolates I should get from the shopkeeper



What is the difference between stress and pressure?

A. 1: Pressure represents intensity of external forces acting at a point but stress represents intensity of internal resisting forces develop at a point.
2: Pressure always acts normal to the surface but stress may also act either normal or parallel to the surface.
3: Magnitude of pressure at a point in all directions remains the same but magnitude of stress at a point in all the directions is unequal.

Answers:
Mirror is not perfect - 179cm
Shopkeeper cheated me! - 22



DEPARTMENT OF MECHANICAL ENGINEERING
R. V. R. & J. C.
COLLEGE OF ENGINEERING
(AUTONOMOUS)
CHANDRAMOULIPURAM
CHOWDAWARAM, GUNTUR