To Develop a Nanotechnology and Green Energy Popularization Program

K. Y. Huang
Department of Bio-Industrial Mechanics Engineering, National Chung Hsing University, Taichung, Taiwan
G. C. Tsai*
Department of Mechanical and Electro-Mechanical Engineering, National I-Lan University, Yilan,, Taiwan

ABSTRACT: Nanotechnology is a new technology and green energy is an important renewable energy. In I-Lan University, we combine the nanotechnology and green energy devices to all students in I-Lan county and not only in the University. In this program, the nano-technological and green energy hand-made practical contents are proposed. To cut a sticky soil continuously to become many smaller parts program to simulate the gecko effect and a small wind turbine hand-made method are designed. These popularization materials are already offered in the summer camp that many k-12 students registered and we found it is successful to introduce these new concepts to them.
KEYWORD: Nano-technology; green energy; popularization

1 INTRODUCTION

Nanotechnology is a new field which includes the nano-tube and grapheme manufacture and application. Green energy is also an important field that related to the earth climate changed very fast and the human society has to change the usage of the energy. Nano-particles, nano-materials, nano-size electronic parts and systems are all new research fields. Nanotechnological concept was proposed by the American Physicist Richard P. Feynmam in 1959. In 1974 Japanese scientist Professor Norio Tanguchi at the Tokyo Science University used the term 'Nanotechnology' first. However it was introduced to the world in 1986 by K. Eric Prexler, an American Engineer and the founder of Foresight Nanotech Institute. The polluted lowly and renewable energy is subject to considers seriously, especially Kyoto Protocol becomes effective in February, 2005, makes the explicit agreement to the greenhouse gas emissions decrement. For different green energy, the wind power and solar energy are more prospects to develop renewable energy sources. The development of nano-technology and reusable energy technology grow up, students must have known update information. Teachers have to offer the basic ideas and skill of these new technologies. If the nano-material and reusable energy technology can be caught up for the K-12 school students, they can understand the future nano-technological and green energy jobs. In this article, we will submit a program that includes the courses, many activities and some hand-made materials to teach the K-12 students. The full procedures are similar to the previous studies [Tsai, 2007, 2011, 2013]. This program hopefully K-12 students can become familiar with the new fields and benefit for their future.

2 NANO-TECHNOLOGY INTRODUCTION AND ITS APPLICATION

One dimension of the nano-material is defined to be less than 100nm. The science of manipulating materials on a nano-scale especially to build nanoscopic devices. A nanometer (nm) is10^{-9} m that smaller than the wavelength of visible light and it is a hundred-thousandth the width of a human hair. Nanomaterials can be made of metals, ceramics, polymers, organic materials and composites that just like conventional or micron structured materials. It has different form such as nanoparticles, nanoclusters, nanocrystals, nanotubes, nanofibers, nanowires, nanorods, nanofilms, etc. Nano-materials can be applied in various fields. The following lists will introduce its applications.

2.1 *Nanotubes as a field emitter*

Field emission involves electrons traveling from some solid surface, generally to a vacuum. Field emitters[Ipn2.epfl.ch/CHBU/NTfieldemission1.htm] require large voltages, and the smaller the emitter the larger the voltage amplification. Nanotubes elongated shape allows for very high voltage amplification [Roco, 2001] shown in Figure1.

2.2 *Hydrogen storage in nanotubes*

When hydrogen burns it produces water and heat, and is highly desirable as a clean fuel source. The theoretical maximum condensation is 3.4wt% for a single carbon nanotube. Through the compression of hydrogen in a single-walled carbon nanotube larger weight percentages of hydrogen can be stored. Currently it is believed that a carbon nanotube matrix could produce the necessary wt%.

2.3 *Another applications*

Carbon nanotubes have been used to help further improve carbon fiber baseball bats. By inserting carbon nanotubes in gaps between carbon fibers where there is only resin, the strength is greatly increased. Carbon nanotubes have improved handle flex and responsiveness for more powerful swings [www.netcomposites.com] shown in Fig.2.

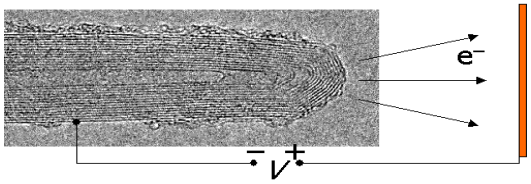

Figure 1. Nanotubes as a field emitter

Figure 2. Easton sport baseball bat

Carbon Nanotube Batteries: These batteries would be created using cellulose infused with carbon nanotubes. The nanotube would act as electrons and be able to provide a steady power output, or provide quick bursts of high energy. All the components would be in a single structure, making it extremely energy efficient.

Water Resistant Material: Hydrophobic Silicon nano-filaments (40-nm wide) are used to coat the material Gaseous silicone is condensed into fibers creating the nanoparticles Its spiky structure forms a protective coating on the material, preventing water from soaking or entering Inspired by natural hydrophobic surfaces such as lotus'. Polyester is the best coated material.

Physical Properties of Graphene: Graphene film has a strength that is almost 100x greater than steel film. It is incredibly thin and light. The Nobel Prize announcement stated that, "1 square meter graphene hammock would support a 4 kg cat but would weigh only as much as one of the cat's whiskers, at 0.77 mg about 0.001% of the weight of one square meter of paper.

3 TO CUT A STICKY SOIL CONTINUOUSLY TO SIMULATE THE GECKO EFFECT

Sometime gecko climbs on the wall very fast. It can climb on the vertical wall and has no any problem to move. Why didn't it fall down even if it climb on the ceiling? The answer is Van der Waals forces that is the molecular attraction force between the negative and positive electric charges. As though Van der Waals force is very smaller, but each thenar of gecko has many millions tiny furs that diameter is around 200~500 nano-meter. One million furs can support 20Kg weight. When many millions nanometer furs work together, the stick force become very big. Based on the test, the feet of a gecko can get 100Kg sticky force. Animal scientist looked into the gecko using the electron microscope and found that the thenar skin is a three layer structures and can contact with any surface perfactly to make gecko move any surface freely. These three layer structures made by lamella that is a soft fin and can be condensed together, therefore, the thenar can contact with the uneven surface like the tree stem or stone. If the gecko climbs on the glass plae, the condensed lamella can be observed from the reverse side of glass plate. In our study, the Van der Walls force is hard to simulate to use a simple material. Therefore a simple idea is proposed to simulate the contact forces due to more and more sontact areas. When the diameter of material become smaller and smaller for the same volume, the contact force will become large with the increased contact area. Based on this idea, three or four sticky soil with the same size and volume are used shown in fig. 3. In fig.4, it can be cut to be a smaller size and can be kneaded to be near eliptic shape as shown in fig.5. In fig.6, one strip of sticky soil is made to be 4 pieces of smaller one and 8 pieces of smaller pieces are obtained as shown in fig. 7. Then put a paer on the different number of stick soil and pull and drag paper along the shear direction to look at the different shear forces. The results can find more and more smaller sticky soil can get higher contact shear force and can prove the gecko effect.

Figure 3. sticky soil

Figure 4. cut to be a smaller size

Figure 5. To form circle shape

Figure 6. 4 pieces sticky soil

Figure 7. 8 pieces sticky soil

Figure 8. put the paper on soil

4 HAND-MADE SMALL WIND TURBINE

In 21 century, the electricity produced by the wind turbine can get the higher efficiency compared with the other renewable energy. Wind turbine didn't produce the pollution materials as done by the chemical energy. After the blade began to rotate, the air will flow through the blade. At this time, the friction and impact of the wind on the blade will produce turbulence plus the eddy current. All of these will make the wind flow become unstable and may reduce the efficiency. The flow field did not only affect the noise produced by the wind turbine blade, but also increase the resistance of the blade rotating which will reduce the efficiency of the kinetic energy transformation. Even if the blade is developed further, the air field in the air space and unstable strong wind environment is changed anytime, therefore, how to get the balance between the efficiency and noise of the wind turbine is a major research topic. In this article the wind turbine concept is introduced and a hand-made small wind turbine is designed to teach K-12 students that they will understand the basic ideas of wind turbine and know the future of the wind turbine technology. The following figures are a practical procedure to produce a small wind turbine.

In this project, the pet bottle shown in Fig.9, LED light, and a small generator shown in Fig. 10 are the simple materials to make a small wind turbine. The first step is to use a knife to cut the head of a pet bottle to make three blades but blade root connected together as shown in Fig.11. In Fig. 12, the blade shape can be adjusted to the form as you wanted. Nest step the LED light is welded to a small generator that each student has to practice. Finally, put the blade to the axis of small generator. It can hold before the fan and LED light will be on when the small wind turbine blade started to rotate. Students can adjust the angle of the turbine blade to see the difference of the electric current.

Figure 9. Pet bottle

Figure10. LED light and a small generator

Figure 11. To make a blade

Figure 12. To adjust blade shape

Figure 13. welding

Figure 14. small wind turbine

5 DISCUSSIONS AND CONCLUSIONS

We designed the course as the above. All of these materials were assigned to the students and ask all students to present their products. After they presented their products, different problems related to a sticky soil to show the nanotechnological concept. A small wind turbine is easily made and can find its efficiency related to the blade angle. It is also found that we will spend a little time to finish the presentation for both of these projects. After performing these two articles, most of students can study the same subjects deeply. The project focused on the nanotechnoly and green energy will match with the world development trend. In the project, experimental units may be redesigned after they learned all of these methods. We also encourage all

students to back home to do the diffeent subject following the project and can get more ideas to reduce the energy consumption. We hope we can continue working to propose more easy methods to popularize the modern technologies and the green energy. In the future, we will do the teaching evaluation and some statiscal calculation to really understand the student response for the future works.

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