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Nano and Polymer Materials

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ABSTRACT

Nanotechnology is an expected future manufacturing technology that will make most product lighter, stronger and less expensive with more precise NANOTECHNOLOGY refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products. NANO PILLAR is a new kind of solar cell they make bendable solar cells by encapsulating the entire cell inside a transparent, rubbery polymer. The design, the researchers suggest, cold lead to solar cells that cost less than conventional silicon photovoltaics. The nanopillars allow using cheaper, lower –quality materials than those used in conventional silicon and thin film technologies. Increment in efficiency, nonopillars that trap more light,.Nanopillars Boost Solar efficiency, A new twist for nanopillar collectors is the topics overcome in the forthcoming pages. NANO PILLARS make more-efficient thin-flim solar cells using existing manufacturing equipment. Recently, Here we developed nano-fibrous poly(l-lactic acid) scaffolds under the hypothesis that synthetic nanofibrous scaffolding, mimicking the structure of natural collagen fibers, could create a more favorable microenvironment for cells. This is the first report that the nanofibrous architecture built in three-dimensional scaffolds improved the features of protein adsorption, which mediates cell interactions with scaffolds. Scaffolds with nanofibrous pore walls adsorbed four times more serum proteins than scaffolds with solid pore walls. More interestingly,the nanofibrous architecture selectively enhanced protein adsorption including fibronectin and vitronectin, even though both scaffolds were made from the same poly(l-lactic acid) material. Furthermore, nanofibrous scaf- folds also allowed 1.7 times of osteoblastic cell attachment than scaffolds with solid pore walls. These results demonstrate that the biomimetic nano-fibrous architecture serves as superior scaffolding for tissue engineering.

Keywords: Adsorption; Nano fiber,scaffold; Protein; Polymer.

1. INTRODUCTION OF NANO TECHNOLOGY

Nanotechnology is an expected future manufacturing technology that will make most product lighter, stronger and less expensive with more precise. Nanotechnology is the “engineering of functional systems at the molecular scale. This covers both current work and concepts that are more advanced” . ‘NANOTECHNOLOGY’ refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products. This is the creation of functional materials systems through controls of matter on the NANOMETER length scale and properties of chemical, biological, mechanical etc.

2. NANO TECHNOLOGY USING IN LATEST EMERGING TECHNOLOGY

2.1 Nanopillar Solar Cells

A new solar cell design could cut cost and is suitable for large scale flexible panels. The technique used to make the cells could be adapted to make rolls of flexible panels on thin aluminum foil, cutting manufacturing costs. The solar cells are make of uniform 500 nanometer-high pillars of cadmium telluride. Both materials are semiconductors used in thin film solar cells. This requires extremely pure, expensive crystalline silicon to achieve the most efficient photovoltaic devices. The Nanopillar design splits silicon’s duties, the material surrounding the pillars absorbs light, and the pillars transport them to the electrical circuit. This increases efficiency in two ways. The closely packed pillars trap light between them, helping the surrounding material absorb more. The electrons also have a very short distance to travel through the pillars, so there are fewer chances of their getting trapped at defects. That means you can use low-quality, less expensive materials.

2.2 Roll-To-Roll Process

- The cost could be 10 times less than what’s used to make [crystalline] “silicon panels”.
- 500-nanometer-high pillars of cadmium sulfide embedded in a thin film of cadmium telluride.

Both materials are semiconductors used in thin film solar cells.

- Absorbs light and creates free electrons.
- The Nanopillar design splits up silicon's duties: the material surrounding the pillars absorbs light, and the pillars transport them to the electrical circuit.

2.3 Increment in Efficiency

The Nanopillar allows us to use cheaper, lower-quality materials than those used in conventional silicon and thin-film technologies. The technique used to make the cells could be adapted to make rolls of flexible panels on thin aluminum foil, cutting manufacturing costs.

3. NANOPILLAR THAT TRAP MORE LIGHT

The new design could lead to cheaper solar cells. A material with a novel nanostructure was developed could lead to lower-cost solar cells and light detectors. It absorbs light just as well as commercial thin film solar cells but used much less semiconductor material.

3.1 Thick & Thin

First they anodize the film to create an arrangement of pores that are 60 nanometers wide and one micrometer deep long. They then expose the foil to phosphoric acid the broader the pores get. Anodizing the film again makes the existing pores one micrometer deeper and this additional length has the original 60-nanometer diameter. Trace amounts of gold are then deposited in these pores as a catalyst to grow crystals of semiconductor material in this case germanium, which is good for photo detectors inside each pore. Finally some of the aluminum is etched away, leaving behind an array of germanium nanopillars embedded in an aluminum oxide membrane.

4. A NEW TWIST FOR NANOPILLAR COLLECTORS

High cost have been a major deterrent to the large-scale applications of silicon-based solar cells.

Nanopillars densely packed nanoscale arrays of optically active semiconductors have shown potential for providing a next generation of relatively cheap and scalable solar cells but have been hampered by efficiency issues. The nanopillars story however has taken a new twist and the future for these materials now looks brighter than ever.

On the left a schematic of a germanium Nanopillars array embedded in an alumina foil membrane; on the right are cross sectional seem images of a blank alumina membrane with dual-diameter pores; inset shows germanium Nanopillars after growth.

A two step "anodization process" was used to create an array of one micrometer deep pores in the mold with dual diameters narrow at the top and broad at the bottom.Gold particles were then deposited into the pores to catalyze the growth of the semiconductor Nanopillars.

"This process enables fine control over geometry and shape of the single crystalline Nanopillar arrays, without the use of complex epitaxial and/or lithographic processes. At a height of only two microns, our Nanopillar arrays were able to absorb 99-percent of all photons ranging in wavelengths between 300 to 900 nanometers, without having to rely on any anti-reflective coatings".

The germanium Nanopillars can be tuned to absorb infrared photons for highly sensitive detectors and the cadmium sulfide/telluride Nanopillars are ideal for solar cells.

5. SOLAR CELLS USE NANOPILLARS TO CAPTURE MORE SUNLIGHT

Optical antennas could help solar cells produce more energy. Inexpensive thin film solar cells aren't as efficient as conventional solar cells, but a new coating that incorporates nanoscale metallic particles could help close the gap.

5.1 Solar Antenna

Solar cells using thin film. Amorphous silicon has the advantage of being much more abundant than the materials used by first solar. The coatings could also be applied to other types of thin-film solar cells, including first solar's to increase their efficiency.

Broadband's nanoscale metallic particles take incoming light and redirect it along the plane of solar cell. As a result, each photon takes a longer path through the material increasing its chances of dislodging an electron before it can reflect back out of the cell. The nanoparticles also increase light absorption by creating strong local electric fields.

Their interaction with light is so strong because incoming photons actually couple to the surface of metal nanoparticles in the form of surface waves called plasmons. These so called plasmonic effects occur in nanostructures made from highly conductive metals such as copper, silver, and gold.

6. NANOPILLARS PROMISE CHEAP, EFFICIENT AND FLEXIBLE SOLAR CELLS

Beginning with low-cost aluminum foil substrates, grows dense arrays of single crystal, negativetype semiconductors arranged as nanoscale pillars. When the nanopillars are combined with a transparent, positive-type semiconductor that serves as a window the resulting 3-D photovoltaic promises efficient, cheap, flexible solar cells.

7. EXPOMEMITIAL PROLIFICATION

Nanotechnology not only will allow making many high-quality products at very low cost but it will allow making new nanofactories at the same low cost and at the same rapid speed. This unique ability to reproduce its own means of production is why nanotech is said to be an expontial technology. IT represents a manufacturing system that will be able to make more manufacturing systems factories that can build factories rapidly, cheaply and cleanly. The means of production will be able to reproduce exponentially so in just a few weeks a few Nano factories conceivably could become billions.

7.1 Nano and Polymer Material Introduction

In the polymer material using in computer science main material of “scaffold”. The “scaffold” using in some computer software. It Supporting Science Learning and Teaching with Software-based Scaffolding. It focused on scaffolding learners in science classrooms to help them develop a stronger understanding of scientific content and practice. It considering these aspects of science inquiry, the framework describes scaffolding approaches that can support learners as they attempt to engage in more authentic scientific inquiry.

Traditionally, most scaffolded software in science has attempted to support learners, where learners are defined as students in classrooms. But if we consider the science classroom context, the complexity introduced by inquiry based activity also impacts the teachers in those classrooms. Therefore, there is now also a growing line of research focusing on scaffolding teachers as they develop instructional practices that revolve around an inquiry-based approach. In this paper, we will use the Scaffolding Design Framework as a basis to describe how software can scaffold students and teachers with authentic inquiry-based science activities in K-12 classrooms.

The framework to describe the areas where students need support in science inquiry, describe corresponding scaffolding approaches to address those needs for support. The framework to include instances of how scaffolded software can support teachers who are developing their science teaching practices.

7.1.1 Foundations for Scaffolding in Software

The traditional concept of scaffolding involves support as provided by a human agent, the notion of scaffolding has also been extended to software, where the software itself acts as the more capable agent that is supporting the learner. Now we can use the notion of software-realized scaffolding by illustrating how some conceptual aspects of scaffolding could be implemented in software. There is now a range of scaffolded software projects in different content areas. While there is a diversity of scaffolded software, many of these projects focus on supporting different science inquiry activities and the science inquiry process as a whole. This deep focus on science inquiry systems from the different complexities that learners encounter in inquiry- based practices. We now describe the notion of an inquiry-based approach for science and introduce the complexities that students and teachers face in those contexts.

7.2 Inquiry-Based Practices and Science Classrooms

General inquiry model as one where learners:

- Pose questions to investigate.

- Engage in exploratory and analytical work to gather, analyze, and synthesize information and data related to their question Synthesize the results of their work to develop an explanation or answer to their question. While this description provides a general inquiry skeleton, the specifics of a given inquiry approach can vary depending on the types of questions being posed or the content area being explored.

Inquiry can provide motivating, active learning contexts situated around personally meaningful questions as a basis for more authentic scientific activity.

In a classroom setting, students not only have to deal with the inquiry process and inquiry activities, but they must also work with peers and teachers, who act as partners and sources of assistance, adding another level of complexity to the work. Aside from students’ need for support, teachers also need support to manage instruction in an inquiry-based classroom. Inquiry-based teaching is more demanding for teachers, both in terms of necessary content knowledge and in terms of classroom management. Because student projects can be open-ended or go in unexpected directions, teachers require a much broader depth of content knowledge, or alternatively, knowledge of how to help guide students towards materials and information sources related to their project investigations

7.3 Scaffolding Inquiry-Based Activities in Science Classrooms

This framework is a useful structure because it is organized in terms of sense making, process management, and reflection and articulation.

Scaffolding sense making involves different strategies that support learners to explore data in different ways and make connections between new scientific information and their prior knowledge.

Two related scaffolding strategies that can help learners make sense of scientific data and concepts involve the composition of software interfaces. Software can be organized around the semantics of the scientific domain they are engaged in.

In order to create system models, students use the software to define the different objects in the system, the variables possessed by those objects, and the relationships between different variables.

Typically, defining relationships in system modeling software involves developing mathematical equations to describe the relationship. Model-It restructures this task by casting relationship development in terms of "real-world" language that is more understandable to students.

Another scaffolding strategy that can be realized with software involves incorporating scientific representations that learners can inspect and manipulate in multiple ways in order to understand different characteristics and patterns in those representations

Teachers have their own challenges in terms of sense making in inquiry-oriented science instruction, which software can also help address. We have developed Knowledge Networks On the Web (KNOW), an environment meant to provide scaffolding to teachers grappling with the challenges of enacting complex, inquiry-oriented curriculum materials. KNOW is designed around standards-based, inquiry-oriented, and technology rich curriculum materials, and uses videos, student work, and other materials and resources designed to help teachers understand how to interpret curriculum so that it becomes more useable in their local contexts. KNOW provides teachers with access to a level of detail and customization that is impossible to achieve using traditional text-based materials, but is ideally suited to the web.

KNOW is designed to leverage the supports provided by curriculum designers with support gleaned from the community of those who have already used the curriculum, and thus have context-relevant experiences to share. Teachers use KNOW employ it variously as a substitute for and an enhancement of face-to-face professional development, as a planning tool, and as a community forum and collaboration environment. Our intent in designing KNOW was to extend the "educative" nature of printed curriculum materials. KNOW is different from other online teacher learning environments in that it is built around specific curriculum materials, as opposed to more general concepts or instructional strategies (such as inquiry or collaborative learning), and thus serves as a scaffold for teachers learning how to enact that curriculum successfully . KNOW embodies an approach to teacher learning that we refer to as "practice-based professional development," which means that the professional development is centered around helping teachers with practices that they will attempt to enact in their classrooms in the near future.

KNOW can help teachers make sense of complex inquiry teaching practices by also providing teachers with unrespectable representations of teaching practice in the science classroom.

7.4 Scaffolding Process Management

Aside from helping make sense of scientific content, learners also need support to engage in and understand scientific practices. The inquiry process can be complex for students and teachers because of its multi-faceted, open-ended nature, which includes a range of activities, many of which will be new to students. Therefore, students and teachers need a range of support to help them manage, navigate, and understand individual process activities and the overall process as a whole. Scaffolding features can support learners in managing their scientific inquiry in several ways.

First of all, scaffolding can provide structure for the complex multi-faceted tasks that learners face in science inquiry. since students new to science inquiry may not necessarily know their activity options or the procedures for carrying out certain tasks, one scaffolding approach involves providing ordered and unordered tasks decompositions to learners. Graphical process maps can provide such decompositions through visual descriptions of the activity spaces that comprise different aspects of inquiry activity.

The tabs in the notepad describe the steps students should follow as they read, reminding them that effective reading should involve a multi-step process where they first skim an article, read the article more deeply, and them summarize what they learned from their reading.

Aside from describing the nature of tasks, software can also support students by embedding expert guidance about scientific practices to illustrate the purpose of different activities or the meaning of different science terms. Such support can make the rationale for different inquiry activities explicit to students so they can decide on their next steps at different points in the investigation.

The previous scaffolding approaches describe how different aspects of the science inquiry process can be made more apparent to students so that they can effectively manage and proceed through the inquiry process. But another approach for supporting process management involves helping students maintain their focus on their work by automatically handling the non-salient activities that do not necessarily have any intellectual impact on students' science learning.

Consider that science inquiry involves managing a range of tools and artifacts, but such management tasks are not necessarily a part of their intellectual inquiry activity and can instead distract students from the more important aspects of their work. Software can provide mechanisms that automatically handle many of these management tasks for students to prevent cognitive shifts between salient inquiry activities and non-salient management tasks.

Teachers also need support in managing the scientific process for students. Again, we present KNOW as a form of software-based scaffolding for teachers learning how to support students engaged in scientific inquiry.

Another kind of process support for teachers involves managing the overall arc of an inquiry-oriented curriculum, as opposed to within-lesson management issues. This can be challenging for teachers who do not have much experience with inquiry-oriented curricula. We have observed that many teachers have trouble with time management, resulting in units that can take far longer to enact than originally designed.

Frequently, when a teacher feels that they have taken too long enacting a particular unit (for instance if they are feeling pressure to "cover" a certain number of topics in a school year), they will end the unit prior to reaching its specified conclusion. When a teacher does not have a thorough understanding of the curriculum designer's assumptions with respect to the flow of a unit, their decisions about how to shorten the unit are unprincipled. An extended curriculum has key dependencies built into it. For instance, a modeling activity may be repeated three times, with each repetition adding a different element of the scientific process for students. A teacher who does not understand this, however, It will likely not view the three activities as a unit and consider it sufficient to have completed only one. This is symptomatic of what we have referred to as a "checklist" mentality with respect to inquiry-oriented instruction, in which teachers translate inquiry into a series of disconnected activities. To address these issues, we have begun to develop a tool within KNOW called the Planning Enactment and Reflection Tool. PERT describes the composition of extended curriculum by making the implicit between-lesson connections and the goals of individual lessons more explicit for teachers. This way, when teachers make choices about how to shorten or otherwise adapt curriculum materials, their choices do not create conflicts or problems for the larger inquiry-oriented goals of the curriculum. PERT does this by allowing teachers to indicate in advance what parts of a unit they are likely to teach and which they are likely to omit. PERT then uses a dashboard metaphor to show teachers the match between the opportunities for meeting particular scientific process goals if the unit is taught as designed and the match that will exist if the teacher enacts the unit as currently planned. Where there are large mismatches (and possibly problematic or "lethal" mutations in unit enactment; PERT helps point teachers to areas in the curriculum they might focus on to address the gaps .

7.5 Scaffolding Reflection and Articulation

The previous two scaffolding categories addressed the different content and process aspects of science inquiry. However, another important aspect of learning that impacts both of these involves reflection and articulation. Different perspectives on learning describe the importance of reflective activity to develop understanding. While reflection and articulation are important for learning, students may also need extensive support to make them aware of the importance of effective reflection and articulation and to help them see what they should reflect on and articulate at different points of their inquiry.

Scaffolding features in software can support learners with reflection and articulation throughout their science inquiry. A common scaffolding approach involves the use of prompts and text areas in the software interface. For example, the scaffold notepad that we described earlier from Idea Keeper also incorporates prompts and text areas to help students analyze and make sense of the different articles they may find in a digital library. When students view a website or article, the notepad is displayed in a window alongside an empty notepad. The prompts in the notepad describe to students the different things they should think about as they skim, read, and summarize the article (e.g., the main idea of the article, the support provided by the article's author, the utility of the article for the student inquiry, the bias that may or may not be displayed in the articles, etc). Additionally, the text areas in the notepad give students a space to record notes pertaining to the different prompts for further review.

Software can support other aspects of reflection and articulation that may not be so apparent. Aside from reflection and articulation in the context of scientific products and information, students also need support for reflecting on and articulating aspects of their work, such as the plans for and progress through the inquiry process. Effective planning and monitoring pose particular challenges for learners, and given the open-ended, multi-faceted nature of the science inquiry process, students need explicit support for helping them constantly take stock of their previous work and make decisions about the subsequent directions of their inquiry.

The PERT component of KNOW presented in the previous section also supports teachers' reflection on their own teaching in inquiry-oriented instructional environments. PERT, which was initially conceived as a planning tool, does this by inviting teachers to return to the system after teaching and update their records by articulating what parts of the curriculum they taught, omitted, or adapted in ways beyond what is specified in the curriculum materials. The process of making past teaching activity explicit in this way fosters teacher reflection, which is a key component of intentional improvement. In this way, reflection and planning (for future enactments) are intimately connected. Our own related research on teacher learning has revealed the importance of revisiting prior teaching iteratively in professional development, in effect switching between planning and reflection, in order to help correct misconceptions and flag problem areas for future focus. Aside from PERT, KNOW contains additional tools to support teacher reflection and articulation, such as discussion boards where teachers are encouraged to both ask questions and share reflections on particular enactments. These reflections are occasionally called and reified as "teaching tips" in the curriculum sections of KNOW. These approaches and others are all valuable as vehicles to promote articulation and reflection among teachers.

8. CONCLUSION

Research on scaffolding continues to uncover a variety of approaches that different agents can employ to support learners as they engage in complex intellectual practices. Traditional views of scaffolding that focus on human interventions to support learners now encompass an additional focus on software interventions that scaffold learners in similar ways. In this paper, we have focused on scaffolding features for software that scaffold learners with science inquiry practices in classroom settings. While scaffold software has focused mostly on supporting students, we have also discussed how software can support teachers with their teaching practices in science classrooms. When we consider scaffolding under these perspectives of "student as learner" and "teacher as learner", we can see how software can actually play a dual role to connect the human and software aspects of scaffolding. Certainly, when the main audience for scaffolded software includes students, the software is providing a direct scaffolding function for those students. While we have specifically focused on scaffolding in a science inquiry setting, this dual support focus is not restricted to a science setting. An interesting research direction would be to consider scaffolding in other contexts and content areas for both students and teachers to uncover similarities and differences in both the conceptual scaffolding approaches and the manner in which those approaches can be implemented in software. By extending previous scaffolding work to also focus on teachers, we can essentially help to develop a wider range of scaffolding strategies that can be provided by both humans and software to the ultimate benefit of students in classroom settings.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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