



THE CASE STUDY ON NANOCRYSTAL FABRICATION OF VIDEO CONFERENCE

May the 14th, 2012
TR - BG

TR students & teachers
(Acarkent Doga Anatolian High School, İstanbul, Turkey)
BG students & teachers
(John Atanasov Electronic High School, Bulgaria)

Lesson Title: “Nanocrystal Fabrication”

Nanocrystal Fabrication lesson link:

<http://vlab.ntse-nanotech.eu/NanoVirtualLab/experimentroom/908f4cedc98349d0b57e781ae3ea29c1>

ABSTRACT

Through employing the Virtual Lab (www.ntse-nanotech.eu) at the web-site designed with a view to achieving this as well as the lesson plans which are inquiry-based lesson plans with reflections of Nano Technology in Science Education Ref. 511787-LLP-1-2010-1-TR-KA3-KA3MP, courses in which students actively participated were given. In the experiment room the teachers can watch teachers guide first in order to implement an experiment with their students.

<http://vlab.ntse-nanotech.eu/NanoVirtualLab/experimentroom/list?page=1&size=5>

INTRODUCTION

In 14 May 2012, the 2st period of 2011-2012 Academic Years, an on-line lesson between John Atanasov Electronic High School in Sofia and Acarkent Doga Anatolian High School students and their teachers were held in guidance of Turkish project expert as moderator. This video conference session conducted in 40 min. and the Toothpicks Activity in the Students’ Guideline of “The Nanocrystal Fabrication” experiment was implemented with students of both schools. During the video conference session, it was aspired to;



- Visualize the formation of the crystallisation
- Understand the structure of the crystals
- Comprehend the effects of crystallisation time
- Acquire the differences between crystals and amorphous solids

The empiric procedure of the implementation is explained in a timely fashion below.

1. While planning the education, integration of inquiry based learning, improving digital and science literacy drawn out in scope of the NTSE project have been taken into consideration and each activity aims to gain these competences.
2. The call for video-conference sessions was sent to schools and they were informed about the requirements of the video conference session.
3. The week before the commencement of the implementation of the empiric process, the project expert has met the students and informed them on the implementation and tried to motivate them to willingly participate.
4. Before the implementation of the experiments, the access to the virtual laboratory and the sections were introduced.
5. The activity was done by the students that formed a circle around a round table in guidance of the moderator and the teacher of Acarkent Doğa Anatolian High School to engage the students into active learning process.
6. The virtual laboratory implementations were conducted through following the steps of the teacher guide of the Nanocrystal Fabrication experiment integrating the steps of Inquiry Based Learning as in the following;
7. Before the video conference students of both schools have read the Students' Guideline of "Nanocrystal Fabrication".
8. Each teacher has implemented the experiment individually in their classrooms according to the steps in the Teachers' Guideline except the Toothpicks Activity which is the last activity in both guidelines.
9. The precipitation of solids and the procedure of forming nanocrystals were enabled to be comprehended by the students with toothpicks symbolising the edges of cubic structure of a nanocrystal.

10. The bottom up approach was instructed through using the toothpicks to let them discover what nanotechnology and understanding creating the products in suitable chemical and physical features through using different approaches.
11. End of the each experiment, the students reflections were gathered to learn their likes, dislikes, challenges and motivations in their new learning.
12. At the end of the video conference students of John Atanasov Electronic High School have demonstrated the electrolysis of water and produced hydrogen and oxygen gases. They also showed the fast combustion of the oxygen gas that was formed.

THE STEPS OF INTERACTIVE TOOTHPICKS ACTIVITY WITH STUDENTS

The students of both schools started doing the activity in guidance of the moderator. The moderator explained and asked them what to do step by step according to the order of steps of the Toothpicks Activity.

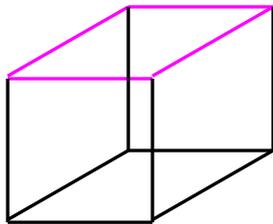
Toothpicks Activity:

This activity should be done on a round table with about 1 meter diameter with students around. 30 toothpicks were given to each student. Each of them aligned the toothpicks in order as shown in the photos below. The students arranged the toothpicks till all of their toothpicks meet in the middle of the table.

Students did this activity first alone, then with 3 friends and last with 10 friends and they were given unlimited time. (The structure formed is long range order crystal structure. The structure formed by only one student can be called single crystal, by three students can be called polycrystalline and by ten students can be called nanocrystalline.)



The students tried this activity with same friends and technique, but; this time, they had only 10 seconds. First the teacher put all the toothpicks on the table and asked them to arrange the toothpicks in the limited time given. The students arranged the toothpicks as fast as they can in 10 seconds and realised the structure formed is different from the first activity. (The structure formed is called the amorphous structure which has short range order).



Atoms form unit cells and they are located at defined points of these cells. Suppose that the atoms form a cubic cell. The top surface of the cube is represented in pink colour. Toothpicks represent either two of the parallel lines on these planes (Fig.1)

Figure 1

When solutions cool down slowly, precipitating solids may form long range orders. Fig.1 simulates the forming of long range order (crystalline structure) with toothpicks.

At first step, the toothpick represented in light blue color (Left hand side corner at the top) is placed on a table with 1 m diameter. Afterwards, place the toothpicks in order of green, red, and dark blue as represented in the figure. This activity can take as long time as you need.

When solutions cool down very fast, precipitating solids may have short range order. Fig.2 simulates the forming of such a precipitation with toothpicks.

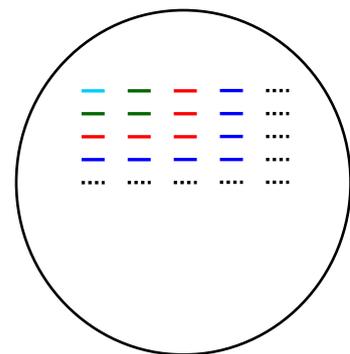


Figure 2

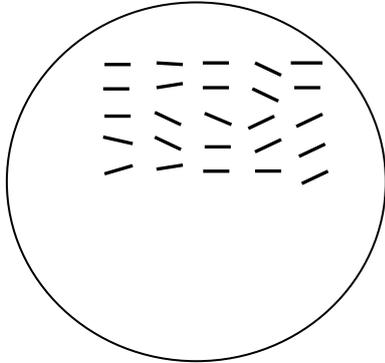


Figure 3

When students tried to arrange the toothpicks in 10 seconds, the sequence of the toothpicks looked like the Fig.3.

Three students start to arrange the toothpicks on the table starting from different edges.

When the toothpick of a student overlaps with another, the sequencing in that direction has to be stopped; however, Sequencing in the orthogonal direction needs to continue overlapping in that direction. Final structure formed is called polycrystalline (Fig.4).

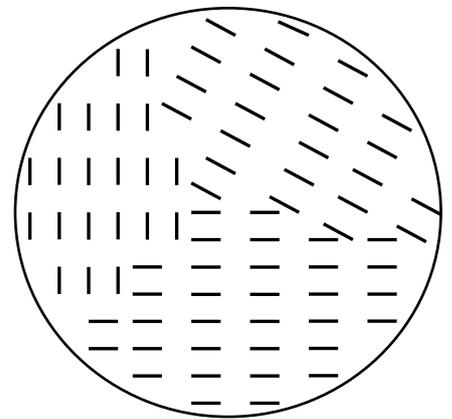


Figure 4

10 students tried to do this activity and they got a structure resembling nanocrystalline structure.

CONCLUSION:

After the call for the video conference was done, the teachers of both schools have implemented the experiment individually in their classrooms and the students have read the Students Guideline. Since the students were informed about the experiment previously, it was easy for them to understand the main concept of precipitation and the formation of nanocrystals. The time dedicated for the activity was fair enough.