EU／Japan Pilot Project

—Report—

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2. Executive summary

This opportunity was my first time I came to Europe. Everything, for instance scenery and people, was very fresh for me. At the same time I had to get information about how to live in Europe. In order to get information, it was necessary to have friends, to have a conversation and to become active. When my behavior was actually active, I was able to obtain a lot of things. From this experiment I could learn the importance of open mind for communication.

Talking of research, it was also needed to act by myself. My research in delft was different to my research in Japan. Since I had no information about my research in delft, I had to understand it at my first step. When I tried to start my research, I noticed that I did not have a space of mine for research. In case of Japan, we have own desk and chair to research. It was a problem for me, because I could not ask anything about research at once when I had some questions. So it was demanded to consider what I questioned by myself till a meeting with my supervisor. If I had been able to ask a question easily, I could understand quickly, but it was very important to understand by myself. From this experiment I could learn an independence of mind.

At the last about my life in Europe I could learn a lot of things through this study abroad and many trips in Europe. I could make many foreign friends and understood their cultures and people. This experience of stay in Europe was so valuable and my sense of value was spread by this experience. The point I have changed is to have been kind for people. They Europeans are very kind for people. So I decided to be kind for people especially foreign people. Another point I have changed is a motivation of learning English. I noticed the importance of speaking English and the need of English more. So I want to study English to be able to discuss any subject.

Through this exchange program, I could develop not only my English skill but also a capacity to adapt myself to the new surroundings. I am very happy to be able to experience this life.

3. Travel Schedule

22/08/2005	Delft University of Technology,	The Netherlands
31/01/2006	Denmark Technical University,	Denmark

4. Technical Report

Title; Modeling of the point crush dressing process
(Profiling of vitrified diamond grinding wheels)

Introduction

Manufacturing technique is continuously developing to increase accuracy and efficiency and lower cost. Especially from the grinding process, higher precision is demanded. Grinding is one of the high precision manufacturing processes and the emergence of hard materials has a big effect on the grinding process. It is not easy to machine hard materials like diamond. So grinding has to be developed to machine these hard materials with accuracy.

There are different kinds of machining operations using abrasives like polishing and profiling. Profiling in these methods is used for producing gears and engine parts which are needed accuracy for fuel efficiency. In order to process desired products, it is needed to shape tools into the negative form of desired products. Profiling is concerned with shaping a grinding wheel into a suitable form.

Attention is focused on profiling, especially profiling of diamond grinding wheels is described. It is a very difficult task to profile a diamond grinding wheel, because diamond has the properties of extreme hardness and abrasion resistance. A new method to profile vitrified bonded diamond grinding wheels is employed. More insight is however needed in the theory behind the working mechanism. The topic of the research is to gain insight in the behavior of the binder material of the grinding wheel.

How to profile vitrified bonded diamond grinding wheels

There are many kinds of dressing or profiling methods which are developed up to the present date. It can be divided into dressing methods for conventional grinding wheels and super abrasive wheels like diamond.

In my research point crushing is employed. A tool for profiling vitrified diamond wheels is shaped like a disc and has a rotational axis. The dressing wheel can be driven.

Fig.1 Point Crushing

The contact between this dressing wheel and a vitrified diamond wheel should be point and relative velocity between them is 0 m/s in this method. This method is very flexible and makes the wear less. So it is used for super-abrasive wheels.

Modeling and Simulation

At first, components of grinding wheel are calculated to make a schematic model. It is needed for this calculation to define the components and guess the percentage of each component in grinding wheel, because the production company of this grinding wheel keeps it secret. Therefore, it has to be considered from known information. The result is below. It can be considered 2 types of different components which are Al_2O_3 and SiC as a supporting grain.

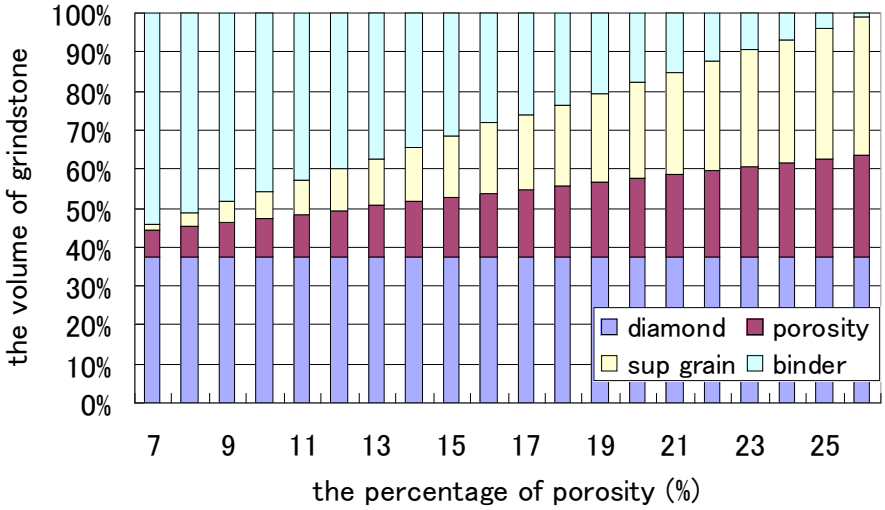


Fig.2 the percentages of the components (Al2O3)

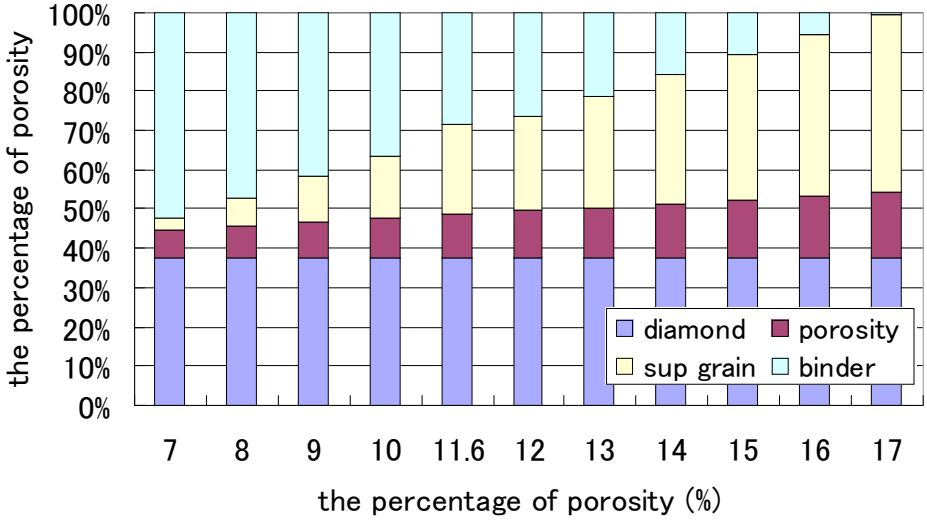
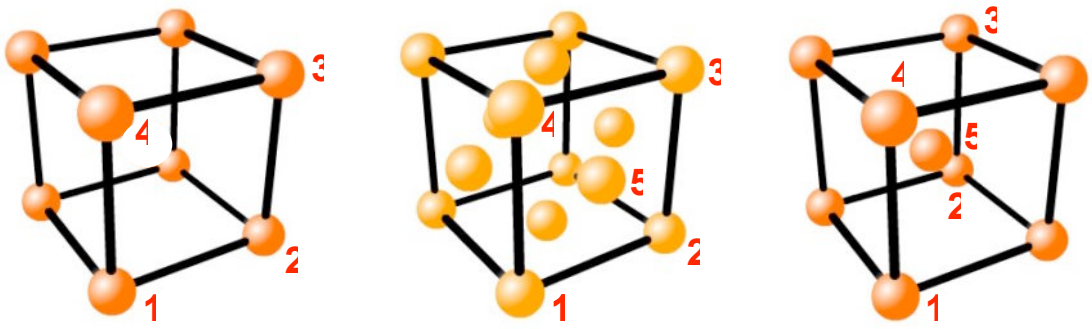


Fig.3 the percentages of the components (SiC)

The middle values of the percentage of the porosity are chosen, because it is considered that the probability of being the middle value is high. The chosen values of components are described below.

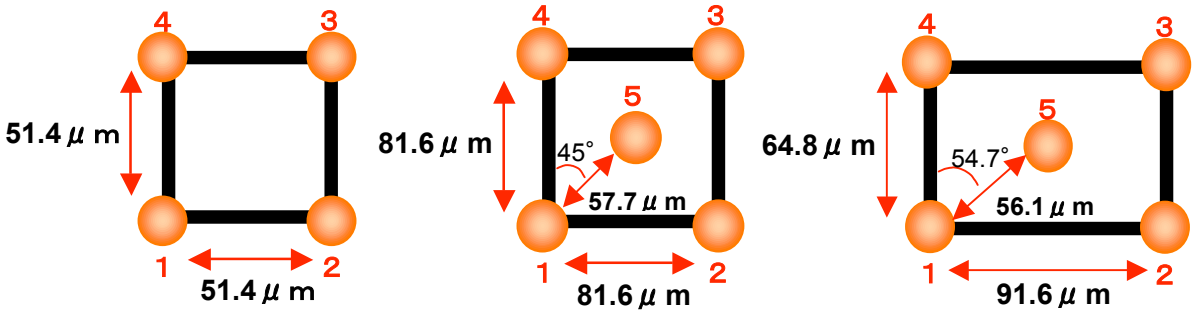
In case of Al_2O_3	porosity	16.3%	In case of SiC	porosity	11.6%
	supporting grain	18.1%		supporting grain	22.5%
	diamond grain	37.5%		diamond grain	37.5%
	binder	28.1%		binder	28.4%

Next step is to calculate the distance between each abrasive to establish a schematic model. In this step supporting grains are ignored, because it becomes so complex if supporting grains are considered, and more constrain condition is needed to run a simulation. Actually each abrasive is randomly distributed, but it is considered with crystal structures. The fundament of crystal structures which are body-centered cubic lattice, face-centered cubic lattice and primitive cubic lattice are considered, and the distance between abrasives is calculated based on these 3 structures



(i)Primitive Cubic lattice (ii)Face-Centered Cubic lattice (iii)Body-Centered Cubic lattice

Fig.4 Crystal Structures



(i)Primitive Cubic lattice (ii)Face-Centered Cubic lattice (iii)Body-Centered Cubic lattice

Fig.5　Distance Between Grains

As described before point crushing is a contour method, the profile is achieved by moving the dressing tool along the profile contour. There is no relative velocity between the crushing roller and the grinding wheel. As a result, a normal force is mainly applied to the wheels. Therefore this method can make the wear less. The wear of the wheel is primarily caused by sliding of the wheels along the abrasive particles.

Buckling, compression, tension, twisting and bending are considered as wear mechanisms. They are examined by running a simulation. The results are below.

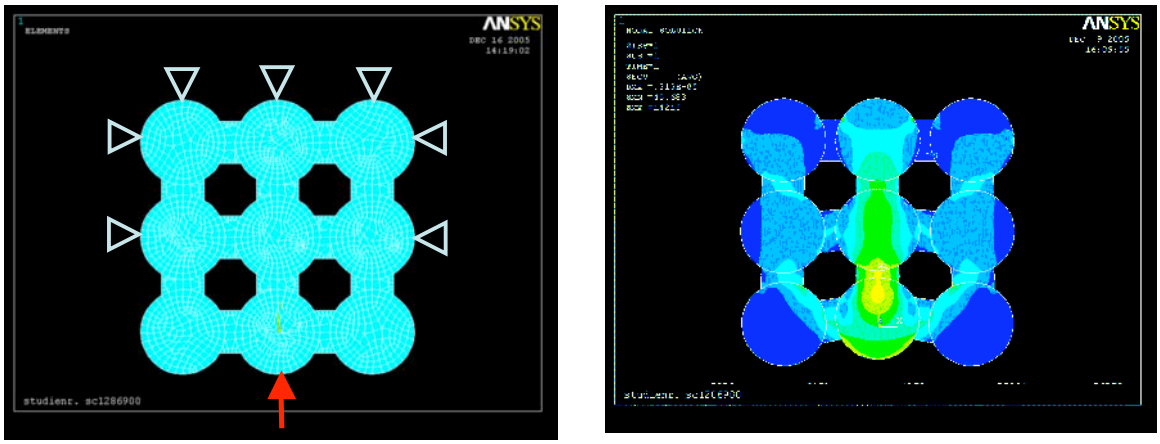


Fig.6 Primitive Cubic lattice

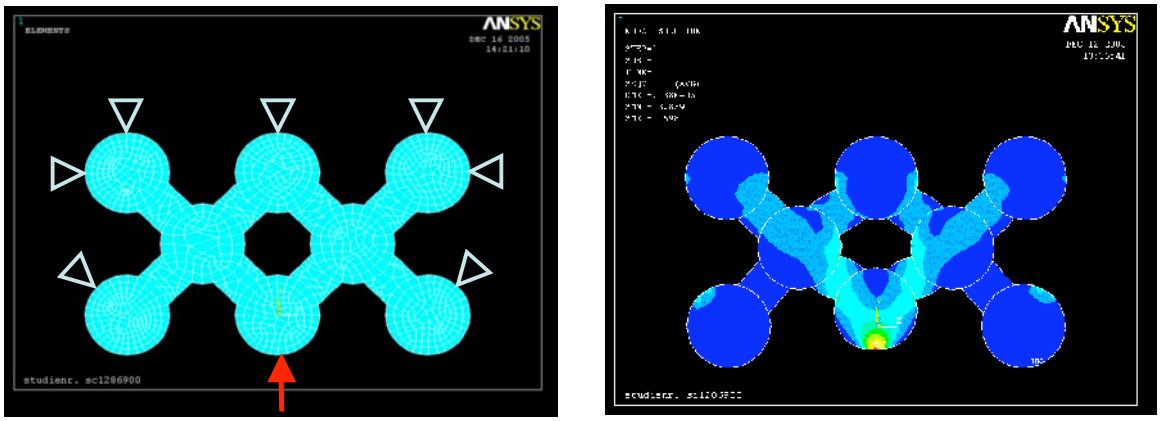


Fig.7 Face-Centered Cubic lattice

Body-Centered Cubic lattice has a similar result as Face-Centered Cubic lattice.

Conclusion

Grinding wheel is dressed with breaking binder, which is supported by simulation using Ansys. Concentration stress such as compression and bend is applied to the binder, then the closest binder from applied force is broken at first and the second

closest binder from applied force is also influenced.

5. Exchange student life

When I reached airport in Netherlands, everything was simulative for me, because it was a first time I came to Europe. People and culture are totally different compared to it in Japan. Sometimes I was surprised at new things that I had never experienced. My first impression was body height of Dutch. I had heard that Dutch were the tallest people in the world, and it was actually true. When I went out to a city, I noticed the difference. There is a bicycle pass painted in red color. At first I did not know where to talk on the street. Furthermore, roads are made of brick. Since I had a big suitcase, it was a tough work to move.

On the way to my accommodation, I got lost. So I asked men how to get there. They taught us the way very kindly. If foreigner gets lost in Japan, perhaps no one teaches anything in English, because we Japanese tend to hesitate to speak English and can not speak English much. At the same time I was surprised at the high level of English skill of Dutch. Everyone can speak English even if they are child in spite of having their own language. I feel that we should emulate Dutch in English, and these experiences let me think of the importance of communication in English.

There is another different thing in service of restaurants, supermarkets and so on. Most shops close on Sunday, and opening hour of shops is shorter. Furthermore, I felt that staffs of shops were not polite to customers. The high quality of service in Japan might be extraordinary. Since these things are the difference of cultures, I thought I had to understand them.

Next, talking of my accommodation in the Netherlands, there are 18 rooms on a floor and 16 Dutch people live in there. Spanish and I had lived in the rest 2 rooms. When I remembered the past experience in my life, I had never experienced communal living. Since I live with my parents in Japan, I had no need to make meals, wash my clothes and clean my room, but here was in Europe. At first there were a lot of unknown things, for example the place of shop, house rules and so on, but roommates helped me. I was gradually accustomed to the Netherlands life and I could make Dutch and other countries friends. Through drinking, dancing, holding a room party and Christmas event, we could understand cultures, customs and people each other.

In the weekends and Christmas week, since I had time, I had a trip to many countries. I planed to go on a trip by myself and with Japanese friends lived in the Netherlands. It was very interesting and exiting. I felt that there were many

differences among countries in Europe, for example faces and character of people, scenery, food, customs and so on. Through trips and life in the Netherlands, I could make friends with Japanese coming to Europe on a same project. We had same time to be in trouble and overcome troubles helping each other. It could be my invaluable treasure.

On a trip with friends, I had an amazing experience that I had never experienced. We crossed the national boundaries on foot. We can not experience it in Japan. This experience became my best memory on a trip.

The second country that I went was Denmark. When I reached there I was hungry., so I found the store. When I was going to buy something, I was amazed. The price of food cost double compared to it in Japan. I realized that Denmark was a social welfare state.

About study, I took a three week course in Denmark, and it was a group work. It was a good circumstance that I could improve my English skill through conversation. In Japan, there are some group works, but I think there are few courses compared to Europe universities. Group work is a good circumstance for students to improve communication ability and obtain knowledge.

Through this exchange student life, I could have a precious experience and learn a lot of things. I thought that the important thing I think was to understand foreign culture.

6. Summary

I am glad to join this exchange program, because I could meet a lot of people and experience foreign culture. This experience makes me widen my sense of value and my view becomes global. Before I came to Europe, my view was limited to only Japan, but after experienced this project, my view was spread to the world, besides I could look at Japan from the view point of the outside in Japan. The things that I could obtain from this experience can help in the future. From now on, I will try to challenge and do not hesitate anything by making use of this experience

At the last, I really appreciate persons who provided this exchange project and were involved in it. Thank you.