

國立交通大學
National Chiao Tung University




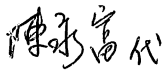
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出國報告 (出國類別：訪問)

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近畿大學
奈良先端大學院大學
德島大學

服務機關：應用化學系 及 分子科學研究所
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備註：出國報告書審核程序如下

- 一、初閱：各處室 A、B、C 類由單位主管；中心計畫及學群 A、B、C 類由各中心計畫主持人。
- 二、複閱：各處室 A 類由國際處；各處室 B、C 類由研發處；中心計畫及學群 A、B、C 類由頂尖計畫執行長。

• 摘要

In Kinki University (Osaka, Japan), I carried out surface tension measurement of lysozyme solution under a supervision of Prof. Yoko F. Yano. I found that the lysozyme molecules adsorb on air/solution interface, which is a direct evidence of local concentration increase of lysozyme at the interface compared to that of bulk solution. This strongly support our finding that laser induced crystallization can be improved by the interface irradiation of laser. On the other hand, in University of Tokushima, Prof. Shuichi Hashimoto and I carried out highly concentrated discussion about three topics, 1. Laser heating of single gold nanoparticle induced gold ion reduction, 2. Nanosecond laser size reduction of gold nanoparticle, and 3. Preparation and characterization of gold nanoparticle doped titanasilicate crystal. Because this trip was very fruitful, the result introduced in this report will be summarized in journal papers soon.

我在矢野陽子(Yoko F. Yano)教授的指導下到近畿大學(Kinki University, 於日本西部的大阪府)量測溶菌酶(lysozyme)溶液的表面張力。發現溶菌酶分子吸附於空氣與溶液的界面，這代表溶菌酶的局部濃度在界面增加了(相較於整體溶液)，這直接且強而有力的證據支持我們的推論—雷射誘發結晶機率可藉由雷射照射在空氣與溶液界面而改善。另一方面，在德島大學(University of Tokushima)時，橋本修一(Shuichi Hashimoto)教授和我嚴謹地討論三個主題：1. 利用雷射加熱的單一金奈米粒子會誘導金離子還原，2. 奈秒雷射對縮小金奈米粒子的影響，3. 金奈米粒子參雜鈦矽晶體的製備與性質。由於這趟行程收穫滿滿，我們將會把這些結果歸納在期刊雜誌上。

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relationship will continue longer. This time, his research proposal, in which I join as a collaborator, is accepted, we need discussion about the topic. Additionally, I have to improve Prof. Hashimoto's equipment about single nanoparticle spectroscopy because he faces to some technical problem.

三、過程

1. Surface tension measurement of protein solution at Kinki University

在日本，矢野陽子(Yoko F Yano) 教授是一位表面分析的權威。

Prof. Yoko F. Yano is one of the authority of surface analysis in Japan. Her major topic is X-ray analysis of solution surface, however, she is also good at traditional surface analysis for the reference. One of the traditional surface analysis is surface tension measurement.

我準備溶菌酶緩衝液以及測量表面張力與溶菌酶濃度的關係式和表面張力與鹽濃度的關係式

I prepared lysozyme buffer solution and measured surface tension as a function of lysozyme and salt concentration. Concerning lysozyme concentration dependence, we found that the value of surface tension in lysozyme solution is much lower than that of water, indicating that the lysozyme molecules adsorb on air/solution interface (Fig. 2). Moreover, it is revealed that the surface tension decreased with increasing lysozyme concentration. This suggest that the coverage of lysozyme at the inface increases with lysozyme concentration. In other words, the local concentration of lysozyme is much higher at interface than that in bulk solution.

Surface Tension measurement

1. Lysozyme concentration dependence

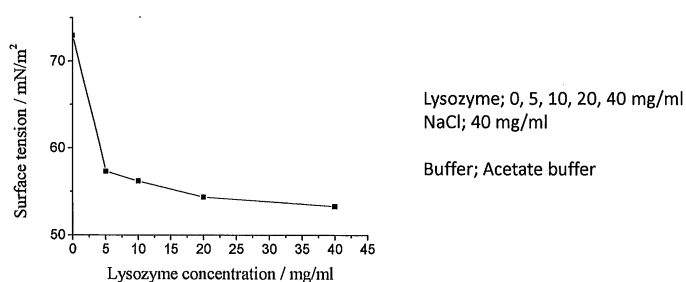


Fig. 2 Lysozyme concentration dependence on surface tension. The buffer is acetate buffer.

With increasing lysozyme concentration, the surface tension decreased.



Coverage of lysozyme at the interface increases with lysozyme concentration.

下一步，在鹽溶度相關的實驗中，我發現溶菌酶溶液的表面張力與鹽的總量沒有太大的關係

Next, in the experiment of salt concentration dependence, I found that the surface tension of lysozyme solution does not strongly depend on the amount of salt (Fig. 3). It is well known that adding

Numerical simulation of bubbling at gold nanoparticle surface

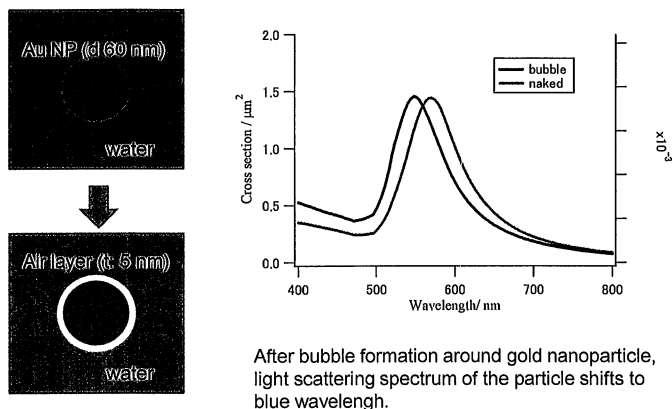


Fig. 4 Numerical simulation of bubbling effect on gold nanoparticle light scattering spectrum on the basis of Mie theory.

四、心得及建議

我成功地測量溶菌酶緩衝溶液的表面張力

I successfully measured surface tension of lysozyme buffer solution. This means that we have got a direct evidence of lysozyme interface adsorption. This strongly support our assumption that the crystallization improvement at air/solution interface irradiation of femtosecond laser pulses can be explained by the local concentration increase of protein at the interface. I think my recent progress is under a nice way. So, I am now summarizing journal papers in hurry.

感謝 MOE-ATU 的專案讓我與橋本(Hashimoto)教授能持續地共同合作, 以及 4 篇成功地刊登在物理化學 C(Physical Chemistry C)期刊上

Thanks to MOE-ATU project, we Prof. Hashimoto and I can continuously collaborate each other and have already been accepted totally four papers by Journal of Physical Chemitry C. And thanks to this business trip, our relationship became more tight and the new research topic could be started smoothly. The current topic will be also summarized in journal papers soon and the new topic will give some results in near future. Hopefully we can continue this collaborative work, because the topic of collaborative work,