



從我的36年研發經驗談起

My Endeavour of 36-Year Research on New Materials



Natural Clays
天然矽土

砂中潛在的寶石(聖經)

(the hidden treasures of the sand)

(Bible: Deuteronomy 33:19)

Why R&D Matters for Taiwan? 2016

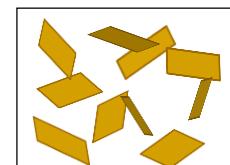
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2016
(台大) JJ Lin 2016



National Taiwan University
JJ Lin Polymer Institute

Why "Mapping" Taiwan? 2014

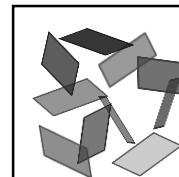
Mapping 台灣關鍵材料產業
—從奈米材料分散之案例說起—

Mapping Taiwan future key materials' industry

Jiang-Jen (JJ) Lin
National Taiwan University

「近代工程技術討論會」METS
Nov 11, 2014

(台大) JJ Lin 2016

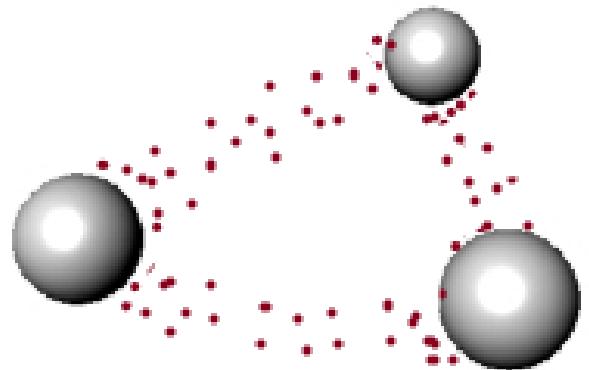


National Taiwan University
JJ Lin Labs, Polymer Institute

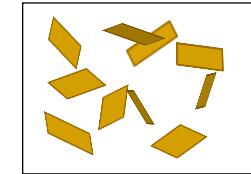
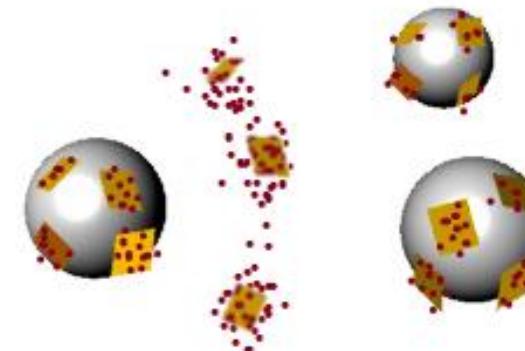
(New Mechanism) Antibacterial by "Physical Capturing" and "Quorum Quenching"

(JJ Lin, Journal of Physical Chemistry C, 2011)

Normal Behavior of Bacterial Quorum Sensing
by sending molecular signals

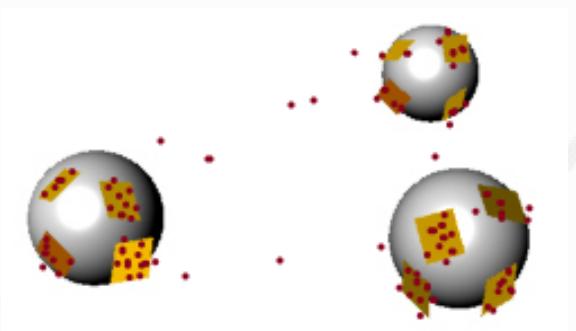


NSP step 1
Intercepting the signals

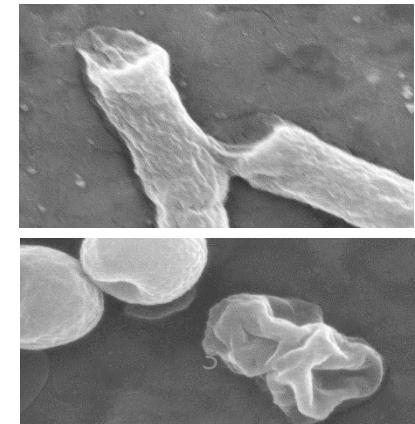
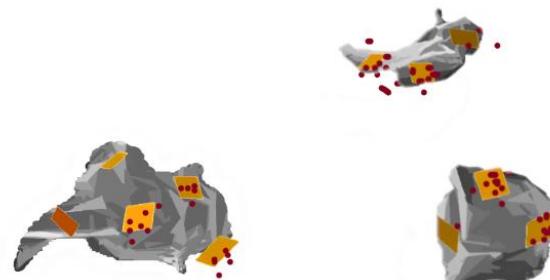


1.0 nm thickness

NSP step 2
physically **adhering** on cell surface



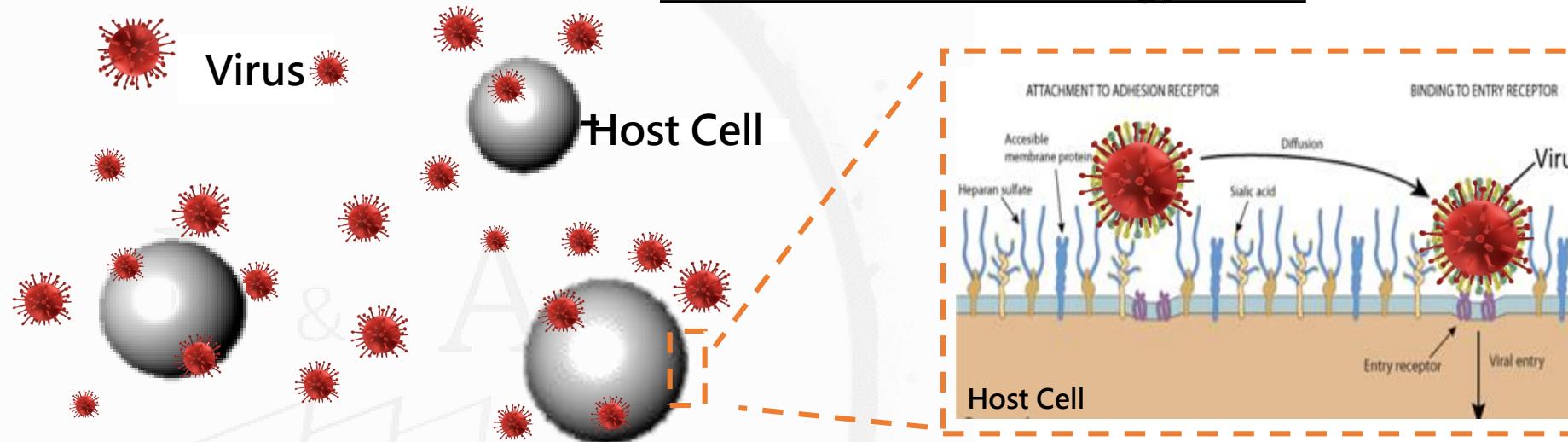
NSP step 3
rupturing and **aggregating** the cells



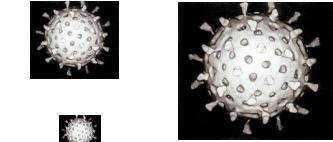
(New Mechanism) Antivirus by NSP Shielding

Physically capturing virus by opposite charge attraction between NSP and virus

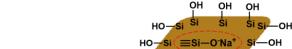
JJ Lin, Journal of Virology 2014



Size compatibility

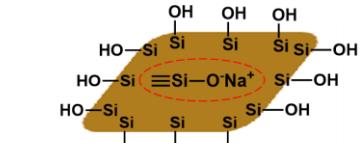
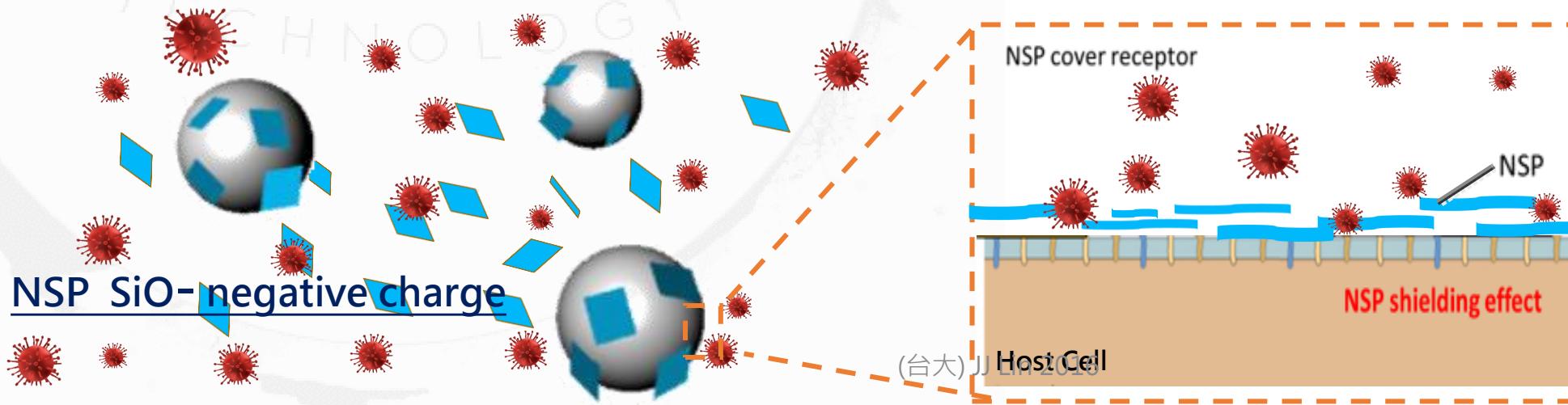


virus (20-100-400 nm)



NSP 100 x 100 x 1 nm

NSP intercept incoming virus



NSP single platelet

100 x 100 x 1 nm

18,000 Si-O-Na⁺

16,000-48,000 Si-OH

Scientific Documentation– Antimicrobial/Antivirus of NSP

JJ Lin (reporting new mechanisms of Physical Capturing bacteria in 2011 and antivirus in 2014)

1. Wei J. C.; Yen Y. T.; Su H. L.; Lin J. J. Inhibition of Bacterial Growth by the Exfoliated Clays and Observation of **Physical Capturing Mechanism**, *J. Phys. Chem. C* 2011.115, 18770–18775.
2. Li P. R.; Wei J. C.; Chiu Y. F.; Su H. L.; Peng F. C.; Lin J. J. Evaluation **on Cytotoxicity and Genotoxicity** of the Exfoliated Silicate Nanoclay, *ACS Appl. Mater. Interfaces* 2010. 2, 1608–1613.
3. Wang M. C.; Lin J. J.; Tseng H. J.; Hsu S. H. Characterization, **Antimicrobial Activities, and Biocompatibility** of Organically Modified Clays and Their Nanocomposites with Polyurethane, *ACS Appl. Mater. Interfaces* 2012. 4, 338–350.
4. Wei J. C.; Wang Y. T.; Lin J. J. **First evidence of singlet oxygen species mechanism** in silicate clay for antimicrobial behavior, *Applied Clay Sciences* 2014. 99, 18–23.
5. Liu T. Y.; Chen C. L.; Lee Y. L.; Chan T. Y.; Wang Y. L.; Lin J. J. **First Observation of Physically Capturing and Maneuvering Bacteria** using Magnetic Clays, *ACS Appl. Mater. Interfaces* 2016. 8, 411–418.
6. Hsu S. H.; Tseng H. J.; Hung H. S.; Wang M. C.; Hung C. H.; Li P. R.; Lin J. J. Antimicrobial Activities and Cellular Responses to Natural Silicate Clays and Derivatives Modified by **Cationic Alkylamine Salts**, *ACS Appl. Mater. Interfaces* 2009. 11, 2556–2564.
7. Chang S. C.; Li C. H.; Lin J. J.; Li Y. H.; Lee M. R. Effective **removal** of *Microcystis aeruginosa* and microcystin-LR using nanosilicate platelets, *Chemosphere* 2014. 99, 49–55.
8. Liang J. J.; Wei J. C.; Lee Y. L.; Hsu S. H.; Lin J. J.; Lin Y. L. **Surfactant- modified nanoclay** exhibits an **antiviral activity** with high potency and broad spectrum, *J. Virol.* 2014. 88, 4218–4228.
9. Liao Y. J.; Yang J. R.; Chen S. E.; Wu S. J.; Huang S. Y.; Lin J. J.; Chen L. R.; Tang P. C. Inhibition of **fumonisin B1 cytotoxicity** by nano silicate platelets during mouse embryo development, *PLoS One* 2014. 9, e112290.

Scientific Documentation—Antimicrobial/Antivirus of NSP-Ag

JJ Lin (reporting new AgNP for anti-MRSA and anti-biofilm)

1. Chiao S. H.; Lin S. H.; Shen C. I.; Liao J. W.; Bau I. J.; Wei J. C.; Tseng L. P.; Hsu S. H.; Lai P. S.; Lin S. Z.; Lin J. J.; Su H. L. Efficacy and Safety of Nanohybrids Comprising Silver Nanoparticles and Silicate Clay for **Controlling Salmonella Infection**, Int. J. Nanomedicine 2012. 7, 2421
2. Su H. L.; Lin S. H.; Wei J. C.; Pao I. C.; Chiao S. H.; Huang C. C.; Lin S. Z.; Lin J. J. Novel Nanohybrids of Silver Particles on Clay Platelets for **Inhibiting Silver-Resistant Bacteria**, PLoS One 2011. 6 , e21125.
3. Chu C. Y.; Peng F. C.; Chiu Y. F.; Lee H. C.; Chen C. W.; Wei J. C.; Lin J. J. Nanohybrids of Silver Particles Immobilized on Silicate Platelet for Infected **Wound Healing**, PLoS One 2012. 7, e38360.
4. Tseng L. P.; Juan C. Y.; Lin S. L.; M. R Doran; Lin J. J.; Hsu S. H.; Liao J. W.; Shen C. L.; Su H. L. Nanohybrids of silver particles on clay platelets **delaminate Pseudomonas biofilms**, Nanomedicine 2013. 9, 1019–1033.
5. Wei J. C.; Yen Y. T.; Wang Y. T.; Hsu S. H.; Lin J. J. Enhancing Silver Nanoparticle and **Antimicrobial Efficacy** by the Exfoliated Clay Nanoplatelets, RSC Adv. 2013. 3, 7392–7397. (note: The hybrids of Ag-NP/NSP (1/99, 7/93 and 15/85) were considered safe in the clinical use by the observation that their LC50 are higher than MIC against both Gram positive and Gram-negative bacterial strains in this report).
6. Lin J. J.; Lin W. C.; Li S. D.; Lin C. Y.; Hsu S. H. Evaluation of the **Antibacterial Activity and Biocompatibility** for Silver Nanoparticles Immobilized on Nano Silicate Platelets, ACS Appl. Mater. Interfaces 2013. 5, 433–443.
7. Huang Y. H.; Chen M. H. C.; Lee B. H.; Hsieh K. H.; Tu Y. K.; Lin J. J.; Chang C. H. Evenly distributed and thin-film Ag **coating on stainless plate** by tri-component Ag/Silicate/PU with **antimicrobial and biocompatible** properties, ACS Appl. Mater. Interfaces 2014. 6, 20324–20333.
8. Liu T. Y.; Ho J. Y.; Wei J. C.; Cheng W. C.; Chen I. H.; J. S.; Wang H. H.; Wang J. K., Wang Y. L. and Lin J.J. Label-free and culture-free microbe detection by three dimensional **hot-junctions** of flexible **Raman**-enhancing nano hybrid platelets, Journal of Materials Chemistry B, 2014. 2, 1136–1143.; Ho J. Y.; Liu T. Y.; Wei J. C.; Wang J. K.; Wang Y. L.; Lin J. J. Selective SERS Detecting for Hydrophobic Microorganisms by Tri-Component Nanohybrids of Silver—Silicate Platelet—Surfactant, ACS Applied Materials & Interfaces, 2014. 6, 1541–1549.

Scientific Documentation

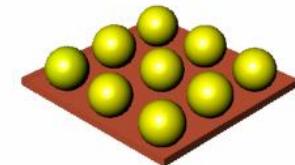
(reporting the applications of NSP, NSP-Ag in agriculture, aquaculture, livestock and water treatment)

the collaborative works from NCHU

1. Treating Plant Pathogens (gray-mold disease) of Strawberry: Ying-Jie Huang, Pi-Fang Linda Chang, Jenn-Wen Huang, Jiang-Jen Lin and Wen-Hsin Chung*, 2016. Effect of Nanoscale Silicate Platelets on Azoxystrobin-resistant Isolates of Botrytis cinerea from Strawberry In Vitro and In Vivo, Journal of Plant Pathology & Microbiology, 7 (4), 1000345. Note: with NCHU Prof Huang黃振文, Prof Chung鐘文鑫, Prof Chang張碧芳; 控制植物病原菌 (草莓 gray-mold disease—灰黴病)
2. Remedy of Water Pollution with Organic Toxins and Heavy Metals and Bacteria by Surfactant-Modified s-NSP: Yu-Jing Liao, Jenn-Rong Yang, Shuen-Ei Chen, Sing-Jhou Wu, San-Yuan Huang, Jiang-Jen Lin, Lih-Ren Chen and Pin-Chi Tang*(唐品琦), 2014. Inhibition of fumonisin B1 cytotoxicity by nano silicate platelets during mouse embryo development, Plos One, 9, e112290; Shu-Chi Chang*(張書奇), Jiang-Jen Lin, 2014. Effective removal of *Microcystis aeruginosa* and microcystin-LR using nanosilicate platelets, Chemosphere, 99, 49–55; note: with NCHU Tang 唐品琦 張書奇; 水質處理--(吸附毒素)(整治湖泊優氧化問題)
3. Controlling Salmonella Infection (in livestock) by Surfactant-Modified s-NSP; Jiang-Jen Lin* and Hong-Lin Su*, 2012. Efficacy and Safety of Nanohybrids Comprising Silver Nanoparticles and Silicate Clay for Controlling Salmonella Infection, International Journal of Nanomedicine, 7, 2421–2423. Note:with NCHU, 蘇鴻麟 畜/漁產類--零抗生素/抗禽流感/沙門桿菌感染(雞.豬飼料/飲水)
4. Prevention of Virus-Infection by Surfactant-Modified s-NSP e.g., 抗日本腦炎、登革熱、禽流感...病毒), Shan-hui Hsu, Jiang-Jen Lin, and Yi-Ling Lin, 2014. Surfactant- modified nanoclay exhibits an antiviral activity with high potency and broad spectrum, Journal of Virology, 88, 4218-4228. Note: with NTU, Prof Hsu徐善慧 (NTU) and Academia Sinica, Dr. Lin林宜玲(中研院).



(New Ag) -- Versatile applications of the Nano-Si-Ag! [奈米矽銀]之多元應用



醫藥/醫療器材: 皮膚敷料, 特殊用抗菌劑, 醫材(植入式骨材)表面抗菌塗料, 凝血/止血敷料
Medical Uses: wound dressing, Anti-MRSA, surface antimicrobial coating (bone/medical devices, blood clotting/hemostatic spray)

淨水處理/過濾材料
Waste water treatment/air filter



低熔點導電銀漿奈米銀粉
Silver/Graphene dispersed paste Nano-Ag powder for conductivity

Colloid, Paste and Powder forms

環境用抗菌、抗霉、除臭、抗菌水溶液
Environmental uses (Ag sprays)

易分散及熱穩定：銀膏、銀粉

安全性: 台大矽銀 > 銅 = 鋅
>> 傳統銀 (高細胞毒性)

紡織品抗菌 (塑膠母粒或塗佈)
抗菌PE/PP/PET膜

Antimicrobial agents for fabrics, package films, 3C equipment...

天然矽片/矽片銀--醫藥/保健外敷用膏
(Panacea-Series)--Personal Health Cares from JJ Lin Labs



- C-Pian mouthwash
漱口水



-天然 natural
-無毒 nontoxic
-抑菌 antimicrobial
-除臭 deodorant
-抗病毒 anti-virus
-牙周病 gum disease

- C-Pian Skin Cream
外敷用膏



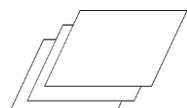
-抑菌 antimicrobial
-舒緩疼痛 (外敷) skin-irritation
-消炎止癢(外敷) anti-itch
-凝血/止血敷料 blood-clotting/hemostatic

有效性: 超級細菌---抗藥性金黃色葡萄球菌
(Methicillin-resistance Staphylococcus aureus (MRSA))

- C-Pian Skin Silver-Cream
(external use only)



-殺菌 antimicrobial
-燒燙傷 anti-burn
-蚊虫蛟傷 after bites



[天然矽片] 衍生奈米材料及醫療/藥物標靶應用

Multi-functional NSP Nanotechnology for Medical Uses

