

OLED Manufacture Challenge: Strategy for Cost Reduction and Yield Improvement

Dr. Yi-Qiang Zhang
CEO

Trovato Technology CO., Ltd
San Francisco, January 27, 2015
a presentation for U.S. DOE Workshop



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Introduction of Trovato Company

2

Cost Reduction and Yield Improvement

3

Marketing & Sale of OLED Lighting in China

4

Conclusion



trovato

Trovato Mfg., Inc
(U.S. Manufacturer)



Trovato Tech. CO., Ltd.
(China Sale & Service)

China Representative for U.S. companies:



LC TECHNOLOGY
SOLUTIONS INC

Gloveboxes

MEIVAC
INC

Sputtering & E-Beam



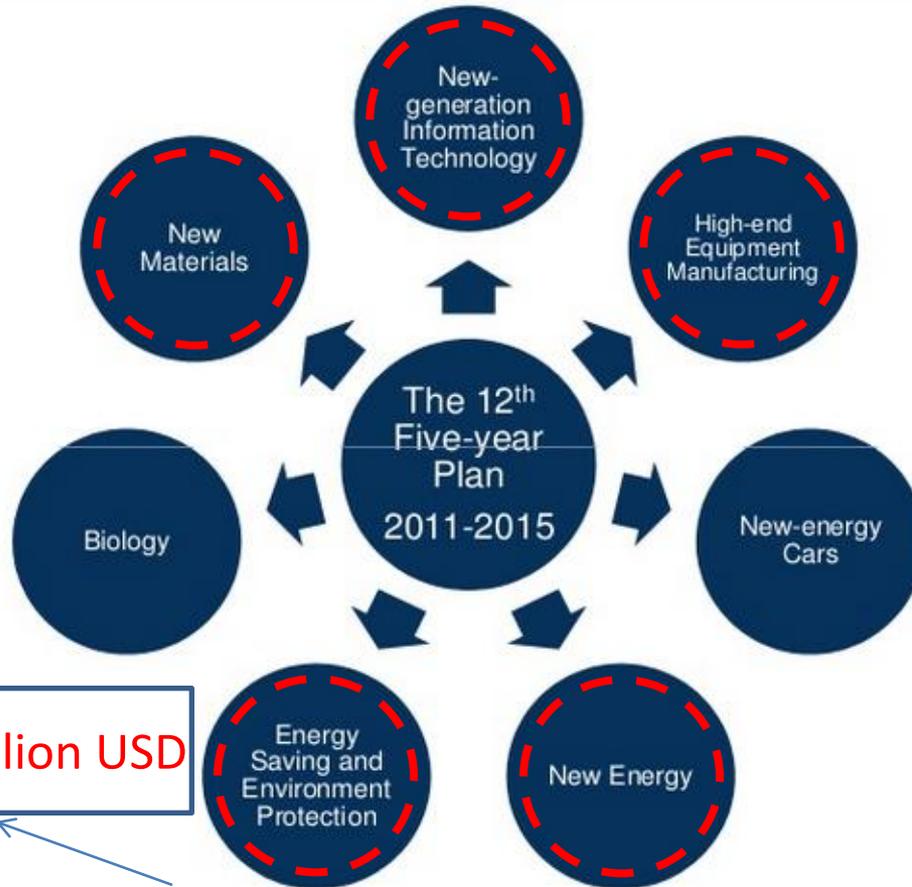
QCM Components

More to come in the near future...

U.S. : www.trovato.org

China: www.trovato.com.cn

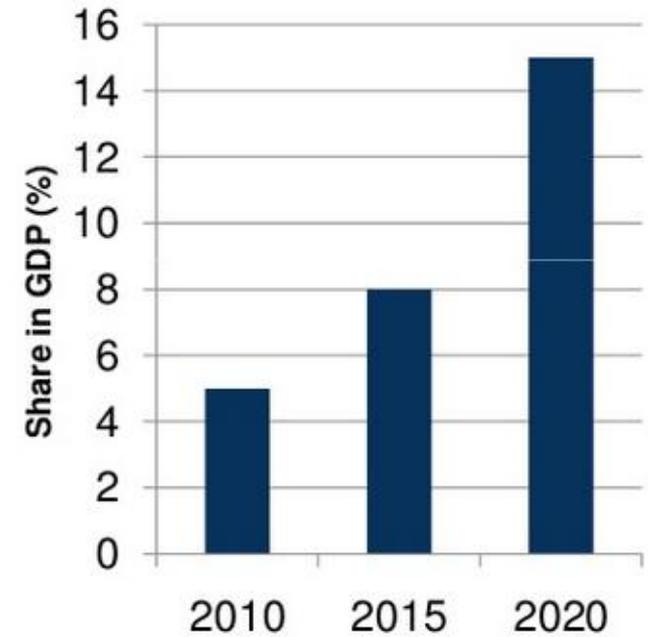
Strategic Emerging Industries during the 12th Five-Year Plan



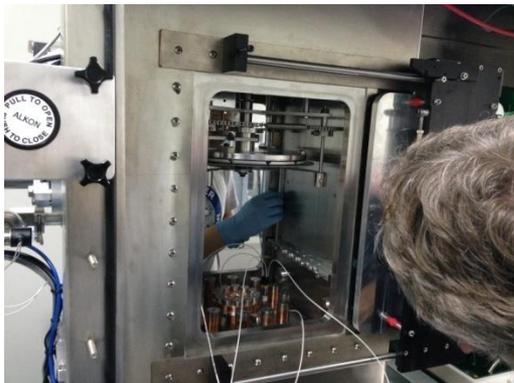
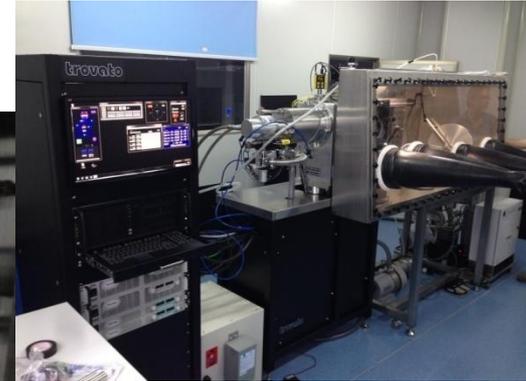
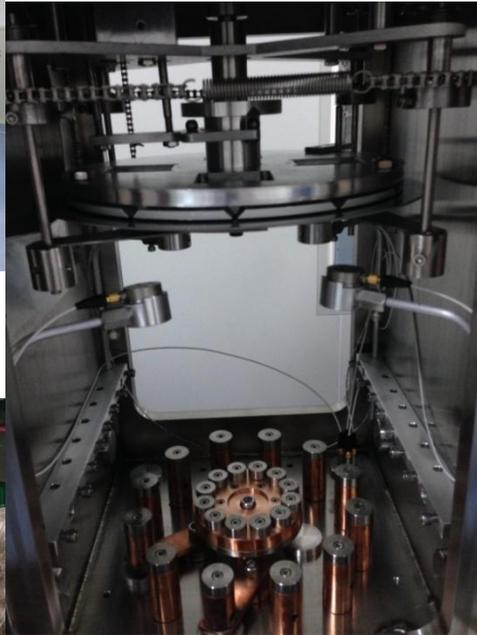
189.4 billion USD

National R&D investment is 1184.66 billion RMB in 2013, 15% annual growth rate

Contribution of the Emerging Industries to the Overall GDP, China, 2010-2020



863, 973, NSF of China...



Market for Trovato systems grows rapidly in China

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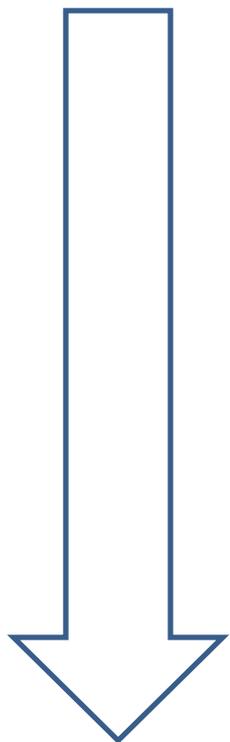
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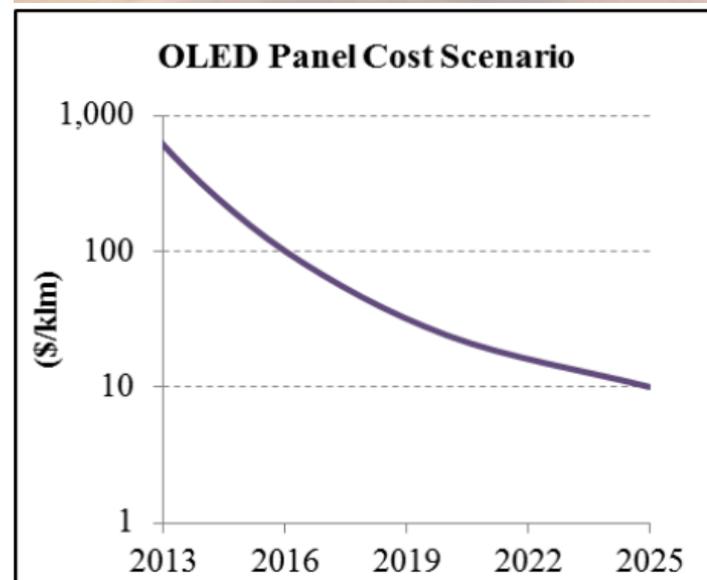


Supply Chain



1. Substrate
2. Materials
3. Stack
4. Encapsulation
5. Equipment

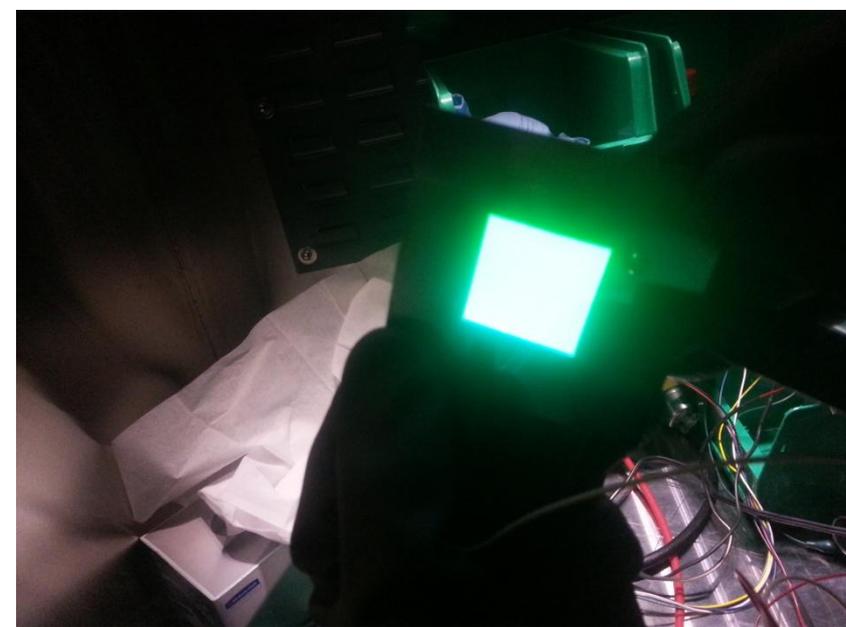
Trovato OLED lab and Trovato system users may contribute to R&D for OLED lighting !



Metal foils: thin metal foils of aluminum (Al) from Alcoa

Advantages:

- (1) Able to achieve DOE cost target, estimated \$7/m² for OLED ready substrates;
- (2) Lightweight, durable, hermetic, and suitable for thermal management;
- (3) In roll-to-roll production, Al foils offer better physical dimension stability and handle stress better than polymeric substrates.



Top-emission architectures: low-cost substrate with planarizing polymer

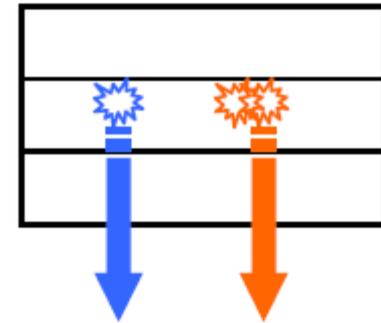
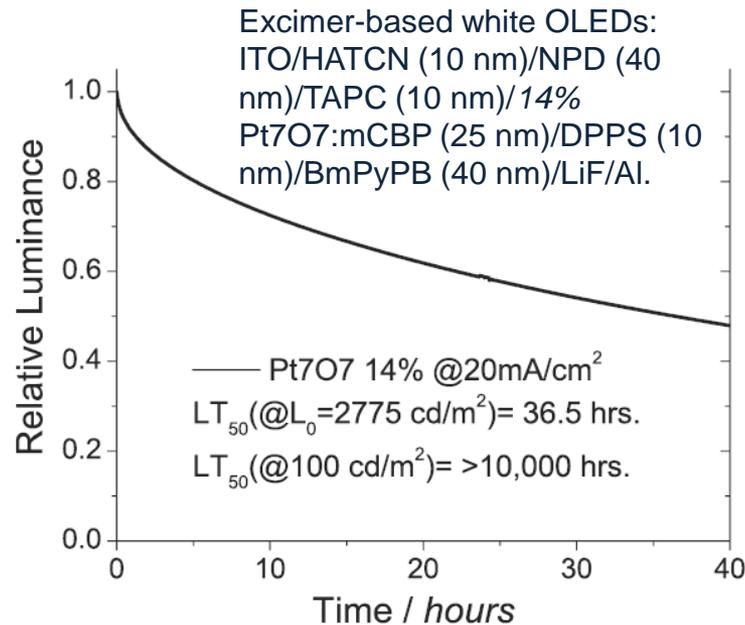
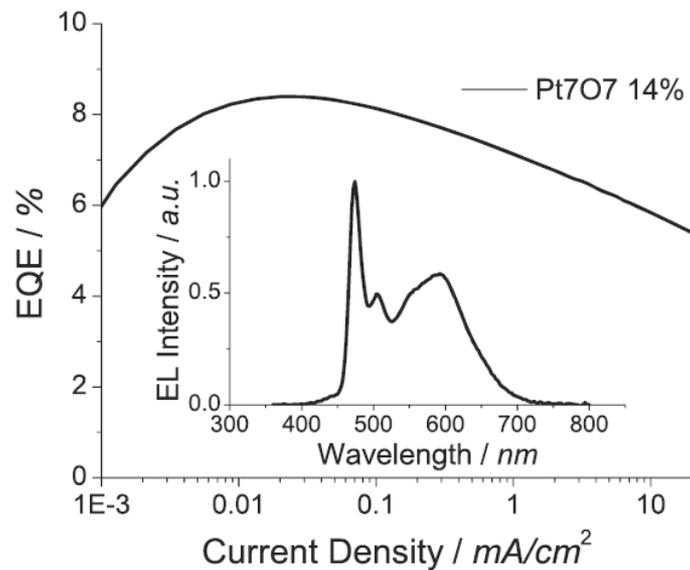
Material development support for lower-cost OLED device fabrication



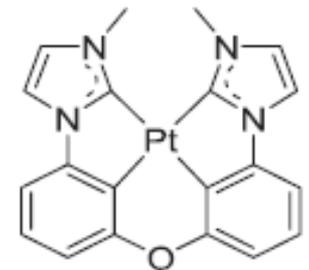
1. Dopant materials
2. Host Materials
3. Electron Transport Materials

Dr. Jian Li at ASU is focusing on efficient and stable White OLEDs using a single emitter, that will enable low cost fabrication by decreasing the complexity of device:

Trovato System User



Emissive layer
with monomer
and excimer



Pt7O7

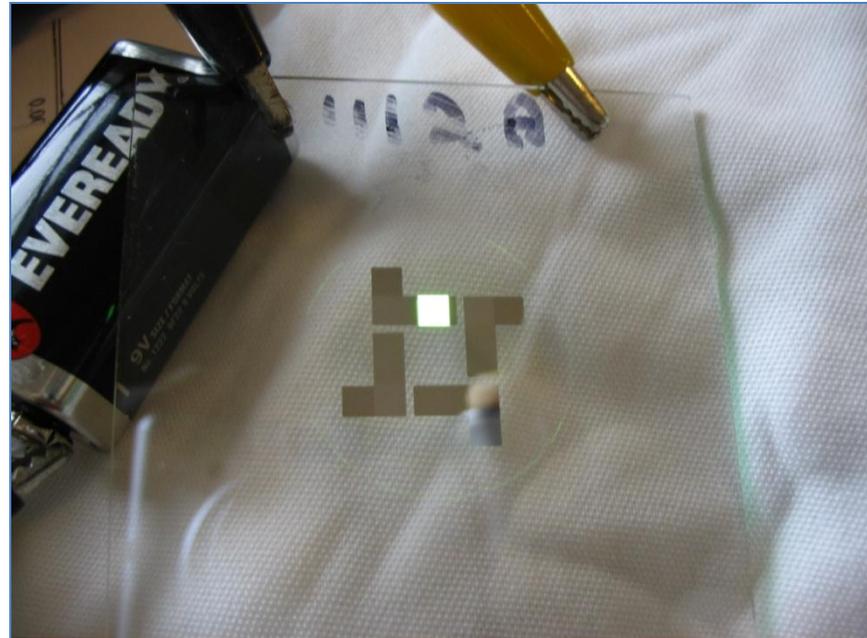
Square-planar
platinum complexes

Benefits:

1. decreasing the complexity of device fabrication;
2. increasing the robustness of materials;
3. lowering the cost of equipment;

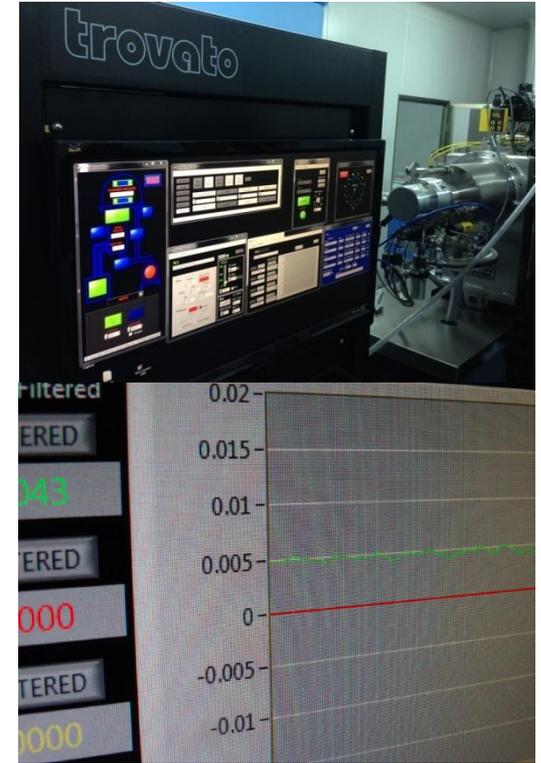
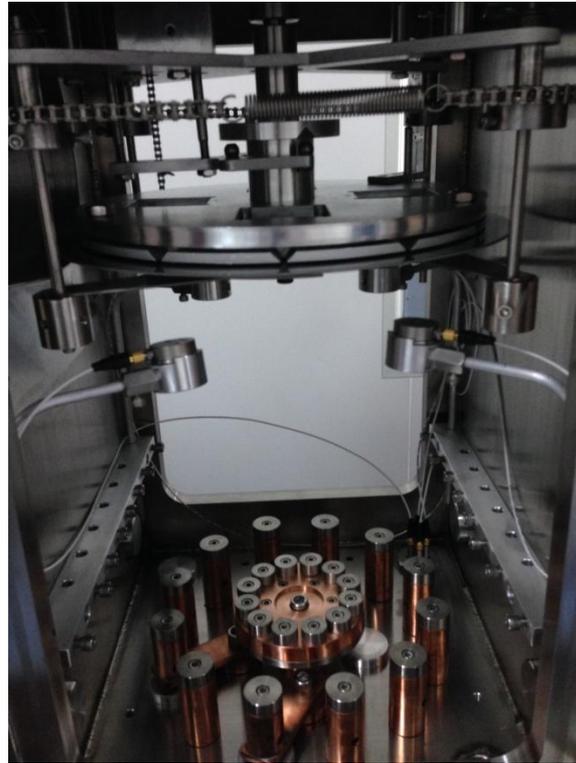
Adv. Mater. **2014**, *26*, 2931–2936

Encapsulation Integrity for OLED lighting panel: sputtering single-layer hermetic seal (Corning)



Benefits:

1. Elimination of desiccants;
2. Improve device stability;
3. Lower fabrication cost;



Features of Trovato R&D tools:

1. Fully Automated Vacuum Control;
2. PC-Based Process Control;
3. 4 Material Co-Deposition;
4. <10 minutes to Process Pressure;
5. Ultra-High Resolution QCM Monitoring;

Vacuum Control

CHAMBER PRESSURE: 1.06E-7

GATE OPEN

VENT OFF

PURGE OFF

REGEN PRESSURE: 0.00E+0

ROUGH CLOSED

CRVO TEMP: 9

REGEN CLOSED

CRVO OFF

MECH PUMP OFF

AUTO

HI VAC ON

VENT OFF

TIME OUT: 30.0

VENT TRIP: 730.0

Enable

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RDX Main Panel

File Help

SOURCE: Xtal Mon.1, QCM Plot.1, QCM Plot.2, Experiment, Record

MATERIAL: Src 1, Src 10-AIQ3, Src 15-NPB

PWR SUP: Xtal Mon: none, AIQ3 3000 Ang 2.0, NPB 800 Ang 2.0

SAVE: PS 1, PS 2, PS 3

Notes

Notes

4:42:30 PM, cross depo test

Note

Add



Power Supply Control

Program Settings

PS 2

AIQ3 3000 Ang 2.0 Ang/s

Rate: Target 1.000, Man./Auto AUTO, Ramp 0.74, Kp 3.00, Ki (Sec) 25.00

Power: Limit 70 (A), Slew 10.00 (A/Sec), 59.35

Thickness: START, Done, Current 112.76, Target 200.00, Filter (Samp) 10

Rate: 0.7187, Stable, Stab. Time 120, Stab. % 10

Auto Zero, Auto Shutter

Power Supply Control

Program Settings

PS 3

NPB 800 Ang 2.0 Ang/s

Rate: Target 0.100, Man./Auto AUTO, Ramp 0.37, Kp 3.00, Ki (Sec) 25.00

Power: Limit 70 (A), Slew 10.00 (A/Sec), 62.01

Thickness: START, Done, Current 201.40, Target 200.00, Filter (Samp) 10

Rate: 0.4042, Stable, Stab. Time 120, Stab. % 10

Auto Zero, Auto Shutter

Fixture Control

Program Settings

MASK: Organic

SHIFT: 0

Motor Ctrl: SETUP, MANUAL

Rotate Speed: 60, 40, -80

ENTER

Fixture Display

EMERGENCY STOP

Organic

0, 180, 90, 270

Plot 1

Program Settings

Plot 1

Chan 2 and 4 only

Raw/Filtered: FILTERED

QCM 1: none, QCM 2: none, QCM 3: XM1-Chan3 (0.7187), QCM 4: XM1-Chan4 (0.4042)

Plot 2

Program Settings

Plot 2

All Chan 0.02

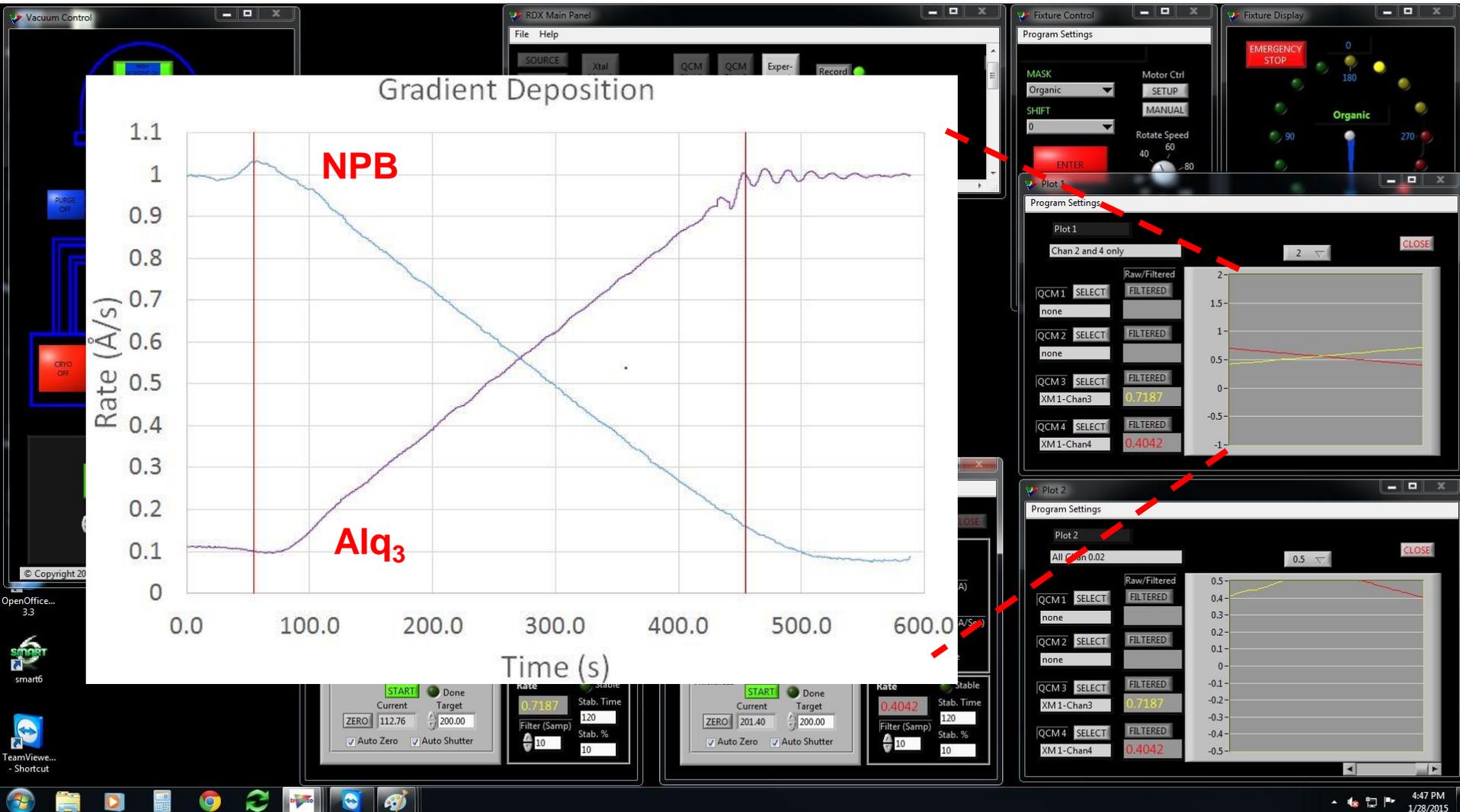
Raw/Filtered: FILTERED

QCM 1: none, QCM 2: none, QCM 3: XM1-Chan3 (0.7187), QCM 4: XM1-Chan4 (0.4042)

OpenOffice... 3.3

smart6

TeamView... - Shortcut



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There are 1.4 billion people in China, and activity in China will help to leverage the fund for potential market of OLED lighting:



Shadowless Surgical Operating Lamp



Eye-shielding Lamps for Children



New Construction Design



Artistic Lighting

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1. Fully International Collaboration is Significantly Important;
2. Trovato Technology may help to lower the cost and improve fabrication yield;
3. China's market will help OLED lighting panel improve marketing penetration;



Thanks for your attention!!!

