

Invited Talk at Southern University of Science and Technology (SUSTC)

How to start a company from scratch – a real story of a professor-turned entrepreneur



Shu Yuan 袁述

Sept. 22, 2016

www.theyuans.com

Outline

- About the speaker
- Why and how I started the the first company
- Tinggi Technologies Private Limited (the first company)
- Quantum Wafer Inc. (the second company)
- Pros and cons of stepping out of the comfort zone
- Lessons learned from the experience
- Conclusion

About the speaker -- Education

- 1995 – 1998 **Australian National University (ANU)**
Postdoc (Australian Research Council PD Fellow),
Department of Electronic Materials Engineering
Processes of optoelectronic materials and design and fabrication of
semiconductor laser diodes.
- 1994 – 1995 **University of Oklahoma, USA**
Postdoc, School of Electrical and Computer Engineering
Setting up the characterization laboratory for testing infrared
materials and laser diodes
- 1990 – 1994 **Johannes Kepler University, Austria**
PhD student, (Semiconductor) Physics
- 1982 – 1990 **Fudan University, China**
Undergraduate Student (Physics)
Graduate Student (Laser Physics)
Ph. D. student (dropped out later on to study Ph. D. in Europe)

About the speaker -- Work

1/2016 – present	SMC Multimedia , a subsidiary of Shell Electric, Hong Kong
	Consultant , business and technology development
2010 – 12/2015	Quantum Wafer Inc. Guangdong, China
	Founder, CEO (General Manager), Board Member
	LED wafers and chips, especially UV chips.
2007 – 2010	Hong Kong Applied Science and Technology Research Institute (ASTRI) , the largest Hong Kong government institute
	Director , LED Devices, MPT Group
	I lead the team to develop a novel technology for power devices and transferred the technology to EpiStar Inc. in Taiwan, then the largest LED company in Asia (ex-Japan).
2001	Founded a high-tech company (Tinggi) in Singapore with private investments
2001 – 2003	Consultant to Tinggi , Singapore.
2004 – 2007	Tinggi Technologies Private Limited, Singapore
	CTO , Executive Director, founder
	Tinggi developed technologies for power LED chips, and transistors, filed patents globally, tried pilot production, etc. The company was sold to Tshinghua Tong Fang.
1998 – 2003	Nanyang Technological University, Singapore
	Associate Professor (1/2002), School of Material Science and Engineering.
	Teaching
	Research

Why and how I started the the first company

Why ? Influenced by others

1. DenseLight Inc. in Singapore ([link](#))

Prof. Lam Y. L. started it

2. Phosistor Inc. in California, USA

Prof. Ooi B. S. started it

3. Company name unknown, California, USA

Prof. Li Y. K.

All these 3 professors are my friends at NTU, Singapore

→ Me Too!!!!



Why and how I started the the first company

Why ?

- Tired of regular professor life style

[PRB04607.pdf](#)

- Bored of walking on campus uphill everyday for 6 years (with a lot of sweat !)



- Developed a world-class new technology

Why and how I started the the first company

How ?

- Read a book



- Teamed up with a local businessman – Angel investor (天使投资人) -- he came up with something like USD 100K

Why and how I started the the first company

How ?

1. Identified an outstanding technology we were developing
2. Came up with a presentation and a business plan
3. Started looking for funding (OPM: other people's money)
4. Use initial little money from the angel investor to hire the first 2 staff: one is a doctor, the other is a bachelor

Why and how I started the the first company

How ?

In 2 years, only 2 employees !

We used university labs

Very soon we ran out of cash !

Cash **burned** fast !

But technology development was slow

So we had to raise fund --- **one of the most difficult tasks**



Why and how I started the the first company

How ?

We approached many potential investors.

→ but **most did not invest.**

Once we got an investor Vertex Inc. , all agreements reached, 4 million US dollars were within reach, but then our **angel investor rejected it !!**

Oh Oh, no more money !

Kept looking for other investors.

Why and how I started the the first company

First meaningful investment : **USD 3 millions !**

+ 2 millions

from the

government

A big day !



Mini-conclusion: how to **start** a company

1. One must NOT be satisfied with her/his current work (or study in the cases of founders of Microsoft, Apple, FaceBook, Google, etc.)
2. One has to come up with a business plan. In the plan one has to identify a few key points :
 1. Potential product (or products)
 2. Potential buyers (users) and thus markets
 3. Why this product is unique (novel technology is often the reason)
 4. When to launch the product
 5. Market shares for this product
 6. Management team and if a technology company key technical persons
 7. **Most importantly (in China) : profit forecast !**
3. Find an angel investor (or borrow money from your rich parents or friends' parents) . To do so you have to do a lot of talking : no shy person !
4. Develop the product as quickly as possible.

And: be prepared for **a lot of headaches** and **sacrifices** and **disppointments** ahead !

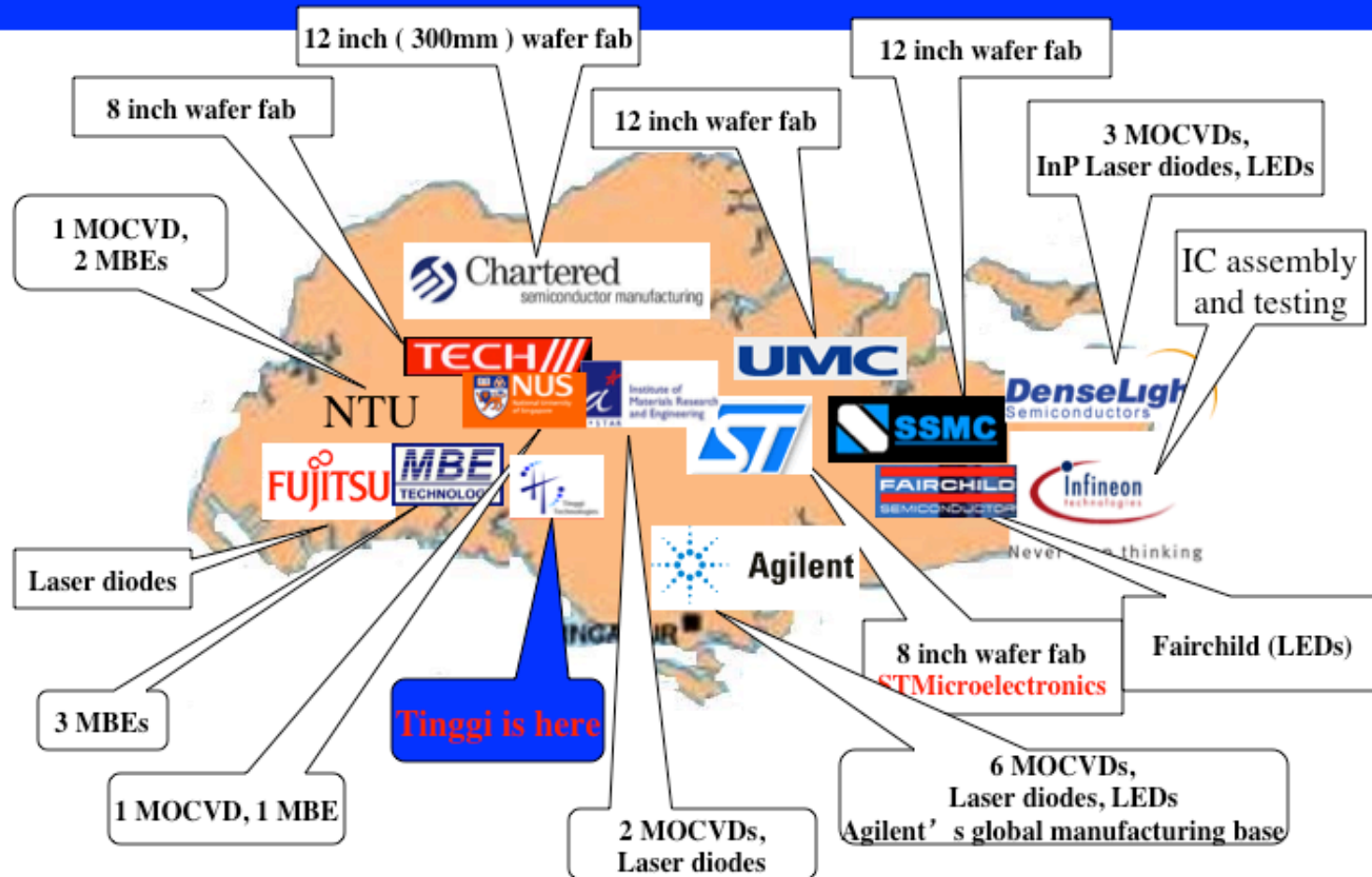
Running a company is totally different from starting up a company !

Note: when I started Tinggi, I did not know most of the above.

Tinggi Technologies Private Limited (the first company)

Singapore and Tinggi around 2005.

Tinggi location--Singapore (~65 km x 40 km)



> 13 MOCVDs & > 6 MBEs & > 3 12-inch (300 mm) wafer fabs

Tinggi Technologies Private Limited (the first company)

[TinggiWaldenPresentation060921](#)

Key problems:

Technology development was too slow
No experience running a startup company

- ➔ Cashing running out fast ([link](#))
- ➔ Unable to defend the technology (there was a copycat company that made almost identical products like ours and even went to list on NASDAQ)
- ➔ Unable to hire and keep the best engineers and business people



Taken over by Tsinghua Tong Fang (清华同方)

四、审议通过了《关于由公司出资500万美元通过下属全资境外企业Resuccess公司收购新加坡Tinggi公司60%股权的议案》

为配合公司2007年度配股募集资金项目“高亮度发光二极管(LED)外延片、芯片产业化项目”的实施，同意公司通过下属全资境外企业Resuccess Investments Limited以自有资金出资500万美元用以增资及收购新加坡Tinggi Technologies Pte Ltd.60%的股权。

Tinggi公司主要从事大功率LED芯片制造技术的开发。2003年以来，Tinggi公司已经通过世界知识产权组织PCT向世界众多国家申请了LED衬底剥离技术、导电导热新衬底键合技术、垂直结构芯片分离技术、表面粗糙化技术等众多基础专利，现已具备批量化生产能力。其拥有的垂直结构LED多项技术与公司目前拥有的高亮度LED外延片、芯片制造技术相结合，将进一步提升公司LED芯片产品的发光效率并降低生产成本，同时使公司LED芯片向大电流、大功率照明级光源领域进军奠定坚实基础。

Tsinghua Tongfang, a listed company in China, invests US\$ 5m for 60% of Tinggi shares to control Tinggi. This is part of Tsinghua Tongfang's RMB 1.9B (US\$ 278m) plan to combine Tinggi's chip technology with Tsinghua Optoelectronics' (清芯光电) wafer technology for mass production of power LED chips in Beijing.

Quantum Wafer Inc. (the second company)

I started to plan for the 2nd company about 3 years before it really was started

[BusinessPlanQuantumWafers0809.pdf](#)

1. Identified the market (LED) and products (wafers)
2. Formed the team
3. Looked for investors
(in Beijing, Tianjin, Shanghai, Chengdu, Shenzhen, and so on)
4. Started the company when the investment came

Quantum Wafer Inc. (the second company)

Presentation of Quantum Wafer Inc. ([link](#))

Video about Quantum Wafer Inc. ([link](#))

Real Examples of on-going business initiatives

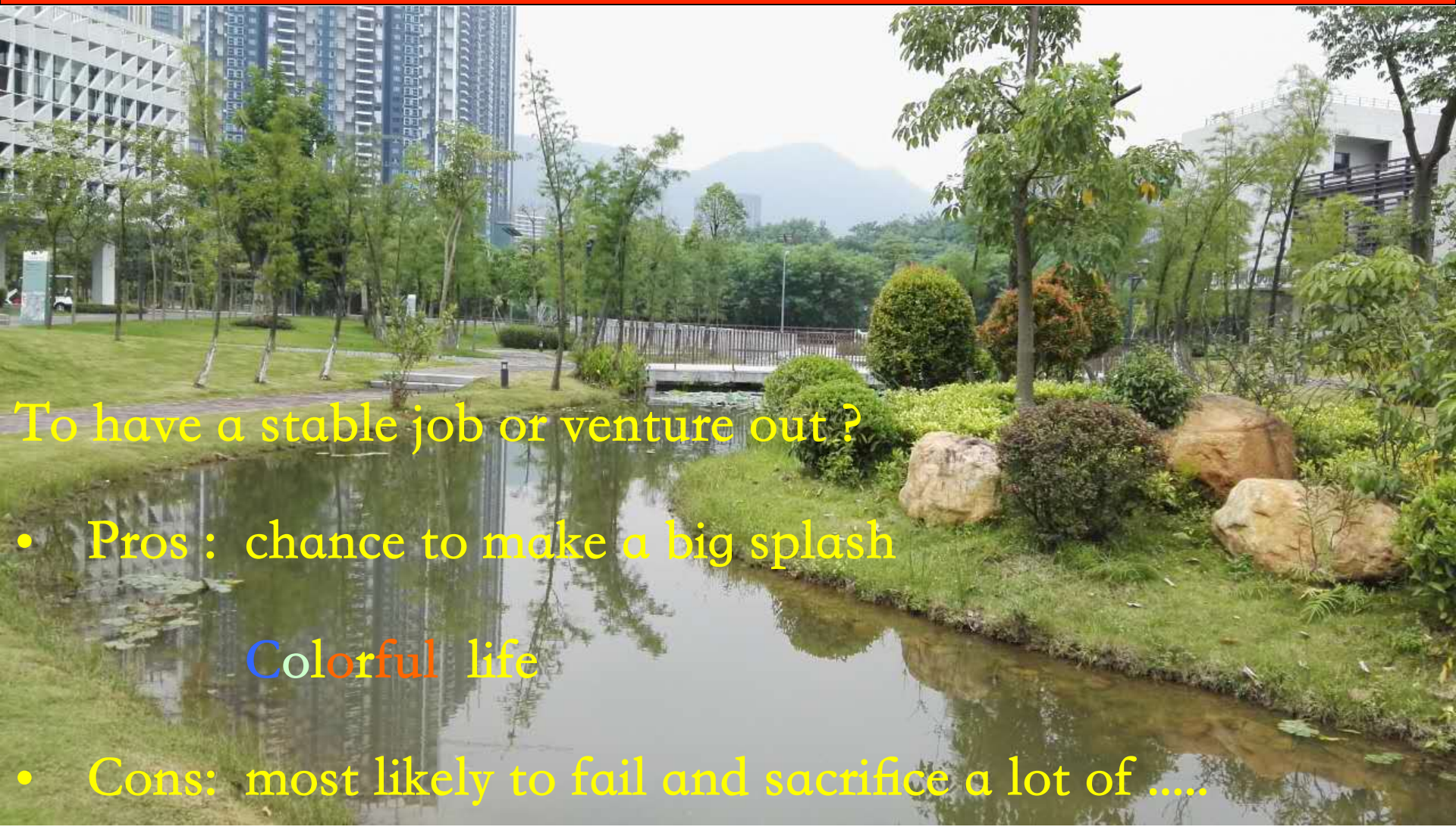
- IvyEducation. ([link](#)) on-line English Learning
(Teachers in the US , students in China)
- 未名科技. ([link](#))
- 未名网 ([link](#)) [新能源汽车网](#)
- 股票网站 www.newlonkong.com

注意：这个网站被骇客攻击，正在处理中，建议暂时不要访问

Conclusion

- A real story was given , full of failure lessons
- There is no fixed path to startup a company
- You do not have to startup a company when you are good at your study (e.g. above the 2/3 of your classmates)
- **Extra information:**
 - Know some basic business concepts (' Rich Dad, Poor Dad')
 - Learn some basic computer program languages
- **Value the privilege of studying at SUSTC !**

Pros and cons of stepping out of the comfort zone



To have a stable job or venture out ?

- Pros : chance to make a big splash

Colorful life

- Cons: most likely to fail and sacrifice a lot of

Be prepared to be brought down to your knees !!

Lessons learned from the experience

- Equip yourself with business knowledge and skills
(Market research, marketing, sales, management, finance, negotiation, operation, etc.)
- Protect your interest such as shares (stocks)
- Be in charge ! (to have final say in the business of the company)
- Find the right persons to work with
- If you have a good job (as I had at NTU), no need to take so much risk
- Do it when you are < 35 (still have time to come back)
- Many more

About Dr. Shu Yuan 2016.1 - Present



SMC Multimedia, a subsidiary of Shell Electric Ltd, Hong Kong

Consultant, business and technology development

Successfully co-developed:

- UV LED Packaging
with Orion
in production since 3/2016
- LED G9 lamps
with Epistar (Taiwan)
in pilot production since 6/2016
- Flashlight LEDs
for mobile phones with
Brilliance (Singapore)
in pilot production since 6/2016



EPISTAR corporation
晶元光電 股份有限公司



Brilliance®
Technologies Co., Ltd.





量晶
Quantum Wafer Inc.

2010 – 2015 China
Quantum Wafer Inc. Founder, CEO
and Board Member



- Started up the company
(Initially investment of RMB 120 millions)
- Converted an old shoe-making building into a modern factory
- Mass production of GaN wafers and chips (handed over to the local holding company to run now)

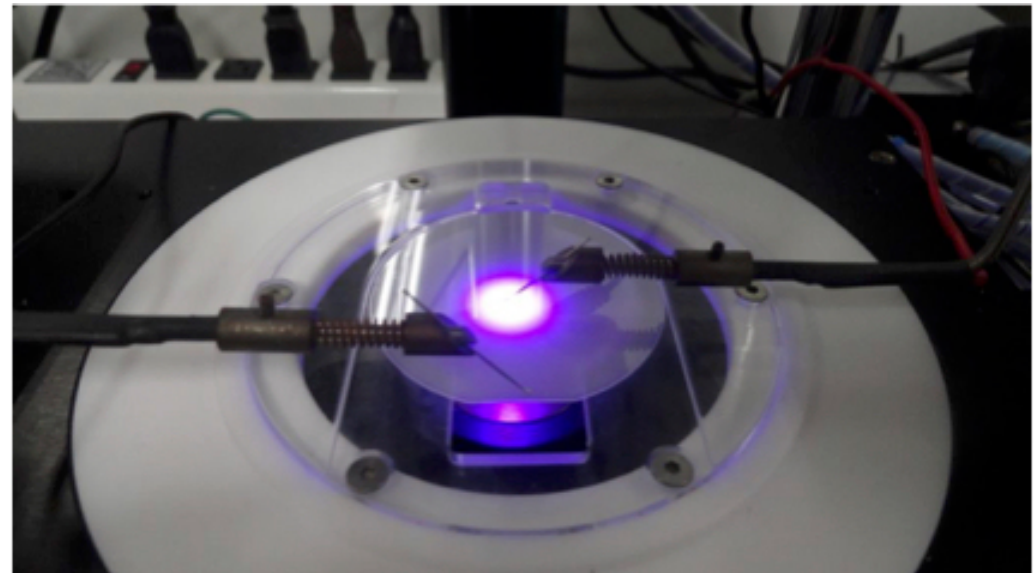
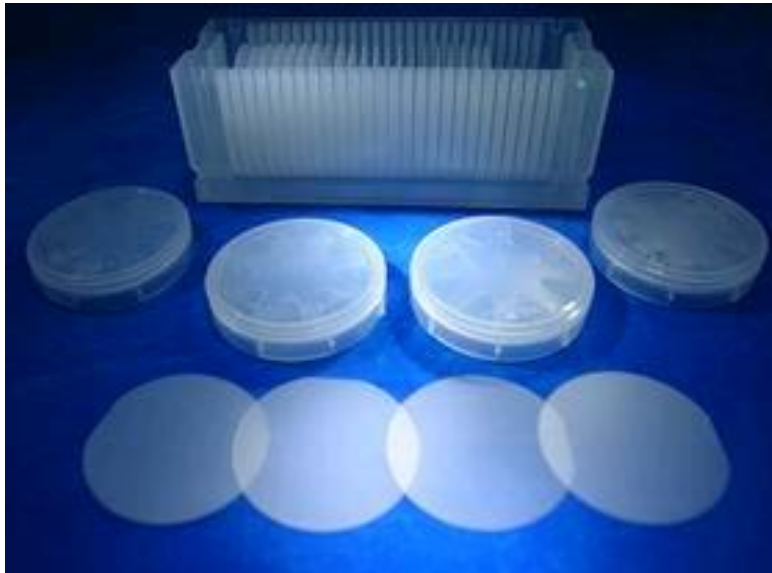


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Quantum Wafer Inc.

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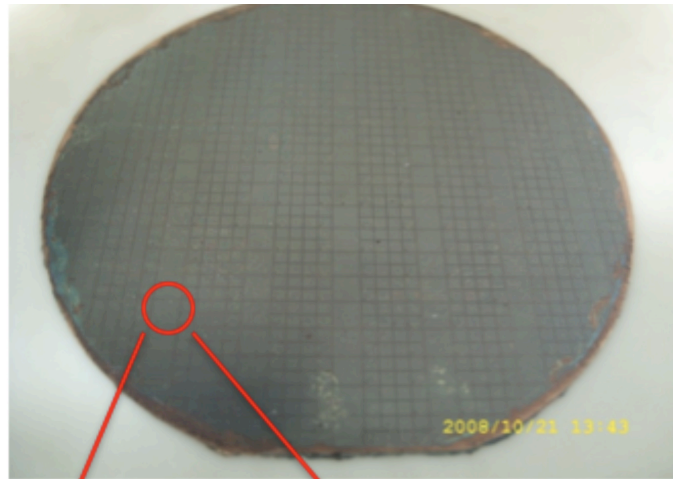


Developed GaN power LED chips and UV LED wafers

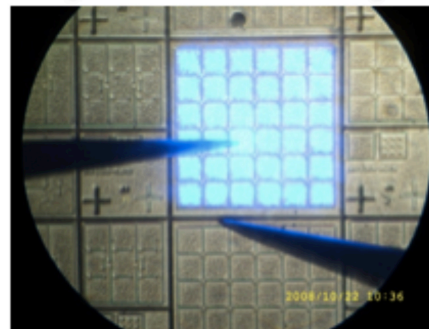




2007 – 2010 ASTRI Director, LED Devices / MPT



Led the device team to **develop** a novel technology and **license** it to the then-largest LED chip maker in the world Epistar (Taiwan)



A 2mm x 2mm mesa



IEEE LEOS magazine features **ASTRI** work

2004 – 2007 Singapore

Tinggi Technologies Private Limited (now part of Tsinghua Tong Fang)

Founder, CTO and Board Member



US008067269B2

Developed technologies
for **power** devices
(LEDs and **transistors**)

(12) **United States Patent**
Yuan et al.

(10) **Patent No.:** US 8,067,269 B2
(45) **Date of Patent:** Nov. 29, 2011

(54) **METHOD FOR FABRICATING AT LEAST ONE TRANSISTOR**

(56)

References Cited

U.S. PATENT DOCUMENTS

(75) Inventors: **Shu Yuan**, Singapore (SG); **Xuejun Kang**, Singapore (SG); **Shi Ming Lin**, Singapore (SG)

3,897,627 A	8/1975	Klatskin
4,107,720 A	8/1978	Pucel et al.
5,192,987 A	3/1993	Khan et al.
5,405,804 A	4/1995	Yabe
5,654,228 A	8/1997	Shieh et al.
5,719,433 A	2/1998	Delage et al.
5,811,927 A	9/1998	Anderson et al.

Tinggi Technologies Private Limited,
Singapore (SG)





2007 – 2010 ASTRI Director, LED Devices / MPT

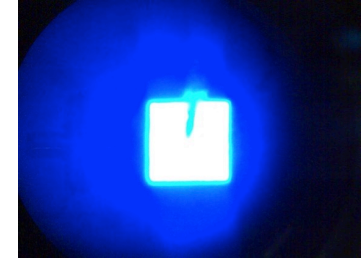
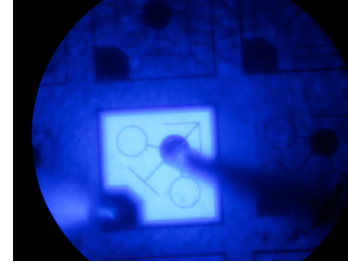
Developed and licensed a novel Power Device Technology

- 11/2007 - 4/2008
Seed Project (HKD 2 m)

Innovative GaN VLED Technology
- 1/2008 – 6/2009
1st Full project (HKD 14 m)

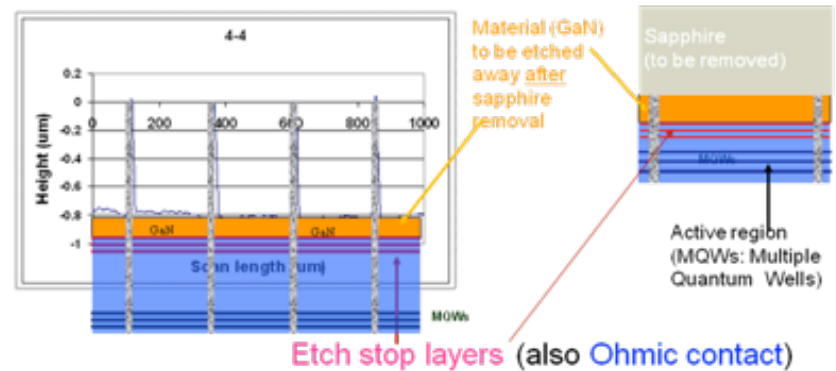
A novel method of removing sapphire for
solid-state lighting power GaN LEDs
- 9/2009 – 2/2011
2nd Full project (HKD 14 m)

Integrated vertical LED technology



Conventional vs. ASTRI Chips

Proposed Project (Method 1): Etch Stop Layers



- Improving :
 - Process uniformity, yield
 - LED chip performance (electrical characteristics)
 - Optical properties (through reduced dislocation density)



About Dr. Shu Yuan 2016.1 - Present

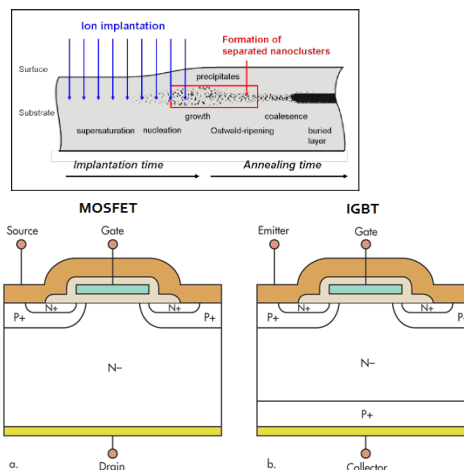


Power Device IGBT devices and modules at SMC

IGBT Design : SMC/Taiwan (done)

Front-end fab: SMC/Taiwan (to production 12/2016)

Backend and Packaging and module: SMC/China

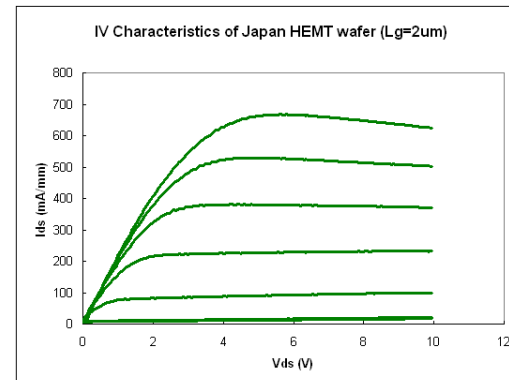
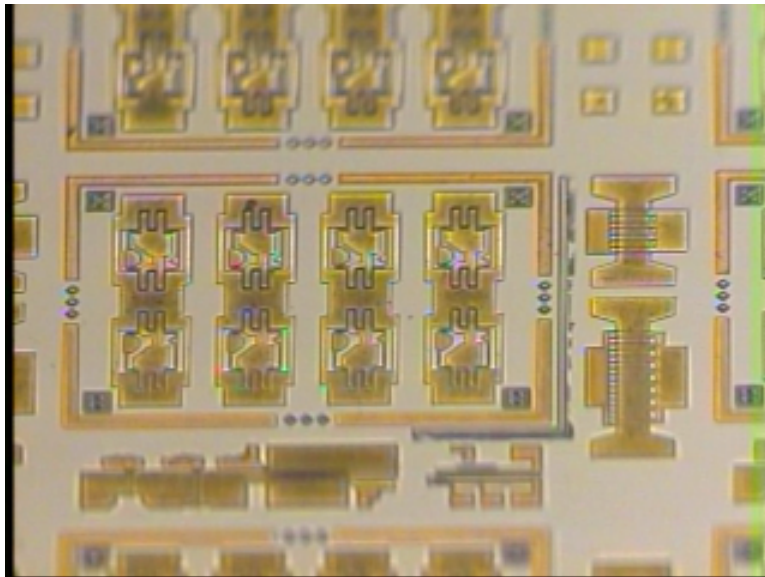


2004 – 2007 Singapore

Tinggi Technologies Private Limited (now part of Tsinghua Tong Fang)
Founder, CTO and Board Member



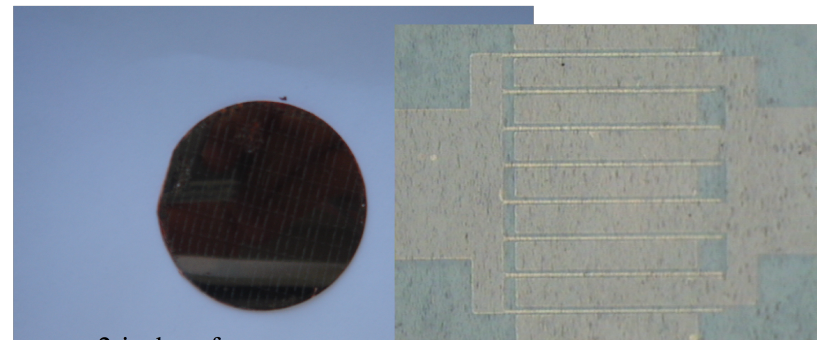
Developed technologies for
power device GaN HEMT transistors



GaN HEMTs - sapphire-removed

Optical images of Tinggi
GaN HEMT devices.

Wafer from Japan, chip designed and
fabricated by Tinggi. (supported by
Singapore Ministry of Defense)



2-inch wafer
With HEMT structures
Sapphire removed !

Optical microscope image
of a HEMT Device on
the left wafer.



1998 — 2003 Singapore Nanyang Technological University (NTU) Associate Professor (1/2002)

School of Material Science and Engineering.

IEEE PHOTONICS TECHNOLOGY LETTERS, VOL. 16, NO. 2, FEBRUARY 2004

389

Teaching:

G166 Engineering Physics,
G167 Common Engineering,
SM103 Physics I,
G269 Engineering Materials.
SM465 Microlithography
SM466 Thin Film Processes
SM469 Microelectronic Process Integration

Research :

Optoelectronic materials and devices
Instrumental in establishing the school's microelectronics (now nanoelectronics) program
and laboratory

High-Power InAlGaAs/GaAs and AlGaAs/GaAs Semiconductor Laser Arrays Emitting at 808 nm

Yi Qu, Shu Yuan, *Member, IEEE*, Chong Yang Liu, Baoxue Bo, Guojun Liu, and Huilin Jiang

IEEE PHOTONICS TECHNOLOGY LETTERS, VOL. 16, NO. 2, FEBRUARY 2004

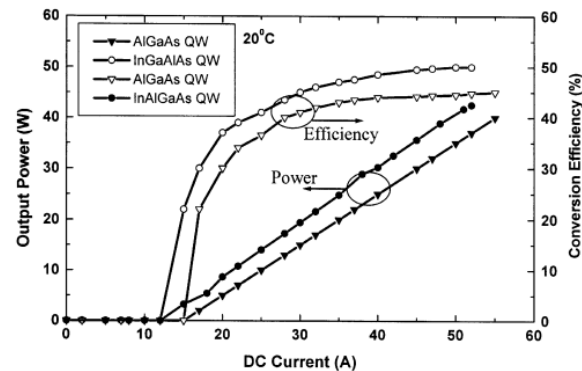


Fig. 1. CW output power and external quantum efficiency of the laser arrays

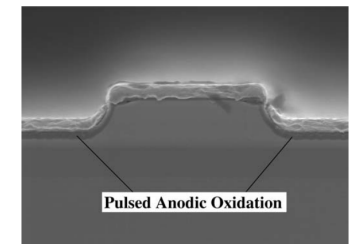


FIGURE 2 SEM image of the ridge-waveguide laser structure fabricated with pulsed anodic oxidation system