

TECH Talk

# Multifunctional Super-wetting Nanocoatings

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**Multiple functions:**

- ✓ Superior anti-reflection
- ✓ Highly efficient photocatalysis
- ✓ Durable super hydrophilicity
- ✓ Transparency
- ✓ Outstanding weathering resistance

**Uncoated** vs **Coated** comparison showing water droplets on uncoated glass and a smooth surface on coated glass.

**Control glass** vs **Coated glass** comparison showing **Anti-fogging** performance.

**Pure glass** vs **Coated glass** comparison showing **Stains** on pure glass and **Self-cleaning** on coated glass.

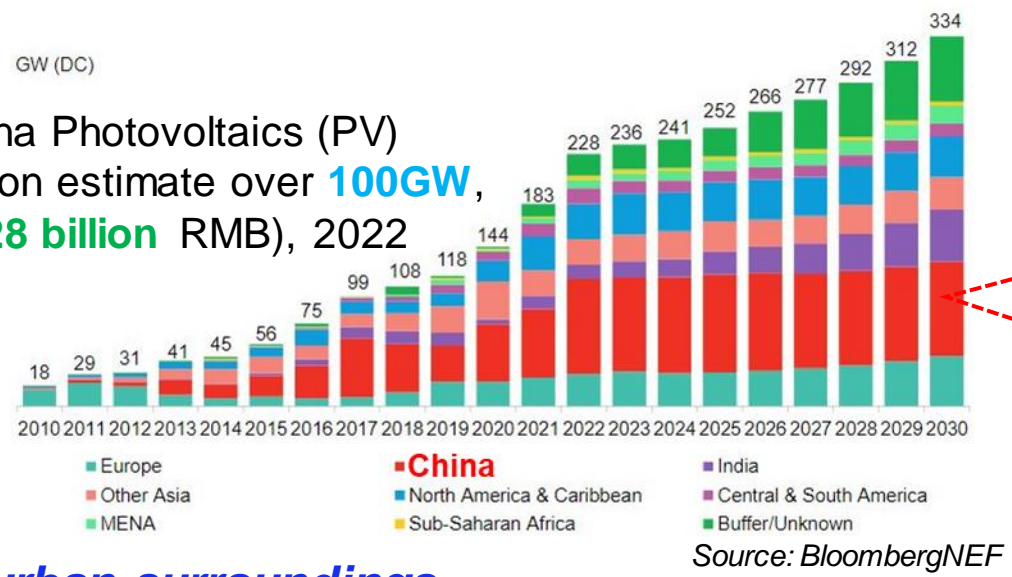
**Substrate** schematic showing the nanocoating structure with red and blue particles on a substrate.

# Outline

- I. Market / Problem statement**
- II. Product / Solution / Underlying technology / Competition edge**
- III. Management team & structure**
- IV. Upcoming milestones on products and business developments**
- V. Business Model Canvas**
- VI. Revenue model**

# I. Background: Key concerns or problems to be solved

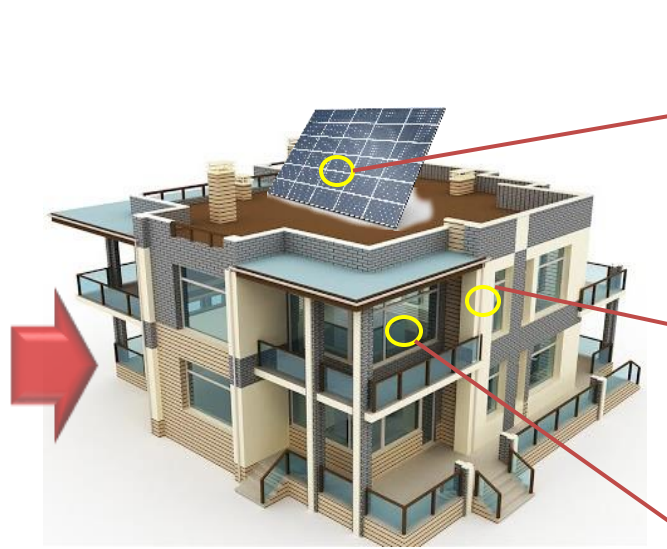
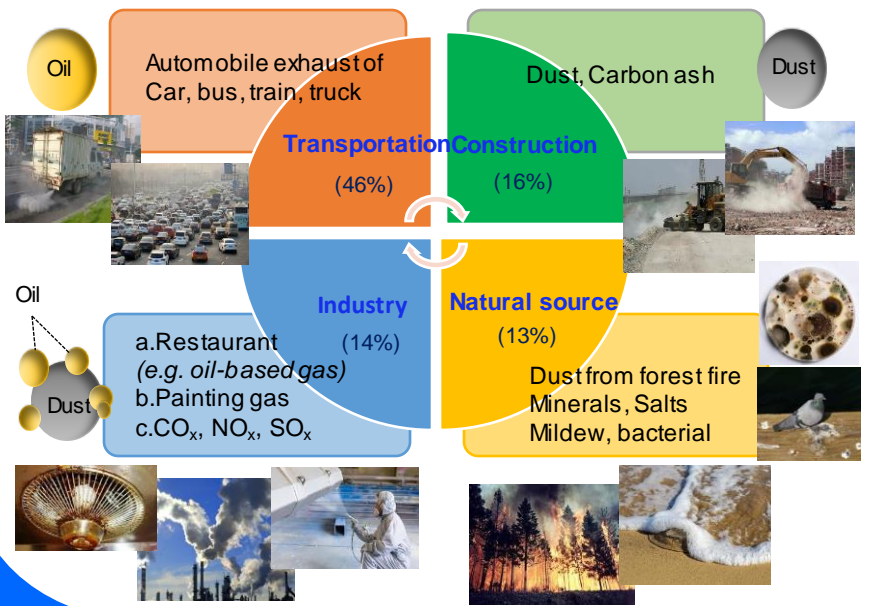
China Photovoltaics (PV) installation estimate over **100GW**, (~428 billion RMB), 2022



HKUST Launched the Largest-Scale Solar Power System among local universities, 2022 (**8,000** solar panels, **50** locations on campus)

## In urban surroundings

- Surfaces of PV panel often **get contaminated**, causing the reduction of solar power generation.
- ✓ Pollutions are mainly **microorganisms and emissions from industry, construction, and transportation.**



**PV panel**: Decreasing power generation

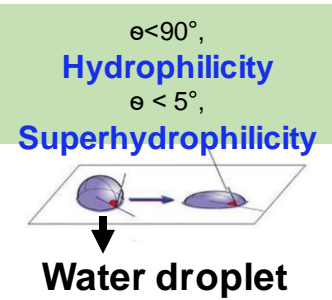
**Building façade**: Consuming labour service

**Glazing surface**: Increasing cleaning cost (~7.5 million in HKUST, 2020)

**Worker falling accidents**

# I. Current technical solutions and issues of coating products for solar panel

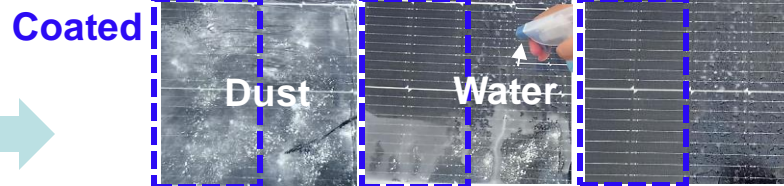
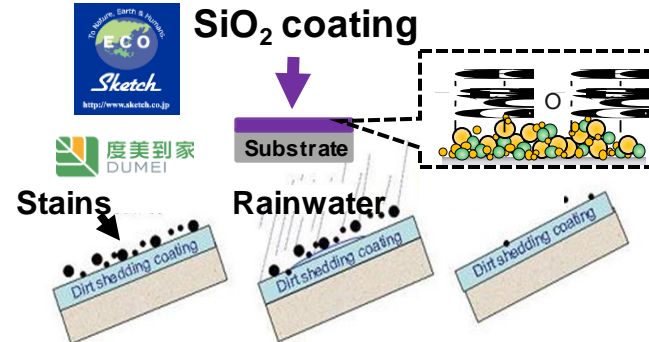
**Superhydrophilic mechanism:**



**Hydrophilic self-cleaning effect**

**Mechanism of products A**

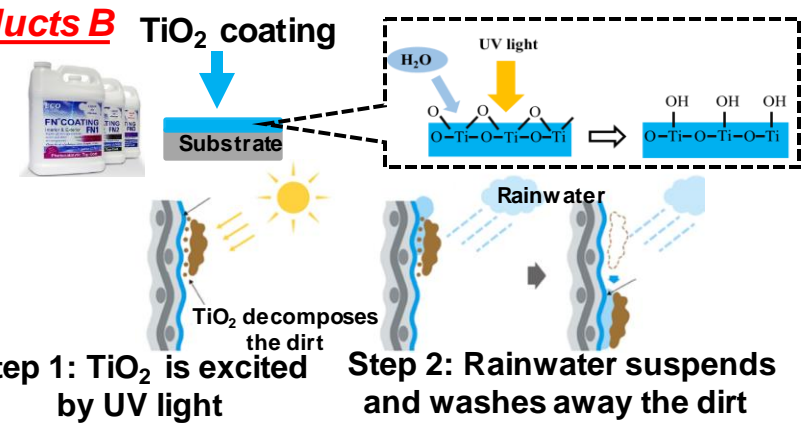
**SiO<sub>2</sub> coating**



**Hydrophilic self-cleaning on solar panel surface**

**Mechanism of products B**

**TiO<sub>2</sub> coating**



**Hydrophilic self-cleaning on glass surface**

**However**

**Avantec® Dumei® Henghui NM®**

**Coated mirror**

**Heating**

Loss hydrophilic effect

**Super bright® Nigrin® Sketch®**

**Coated mirror**

**Low efficient photocatalysis**

Wetting properties

Transparency

Aging resistance

Anti-water resistance

Adhesion

Low cost

Chemical resistance

Legend: Super bright (red), Nigrin (orange), Henghui (yellow), Avantec (green), Dumei (cyan), Sketch (blue)



- ✓ Anti-reflection
- ✓ Anti-abrasion
- ✓ Efficient
- ✓ Transparency
- ✓ Durable super hydrophilicity
- ✓ Simple synthesis process
- ✓ Anti-dust
- ✓ Low-cost
- ✓ Easy-application
- ✓ Easy-application

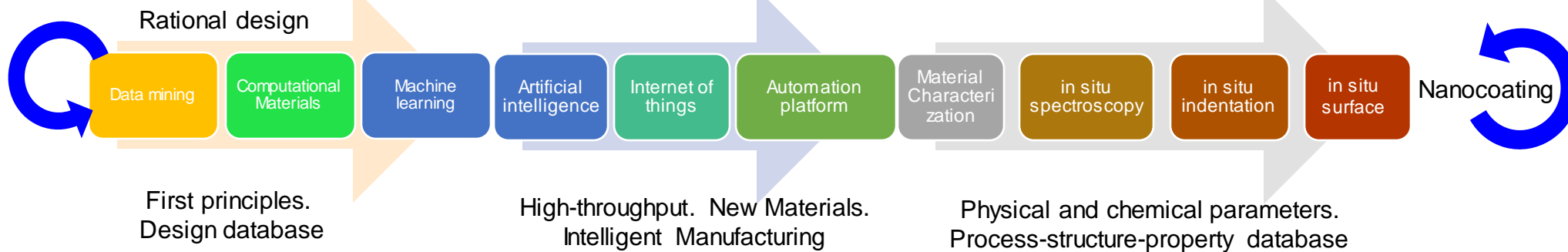
**Large band gap: 3.2 eV. Only absorb < 387 nm UV light!!**

# II. Our unique technology and innovations (1/2)

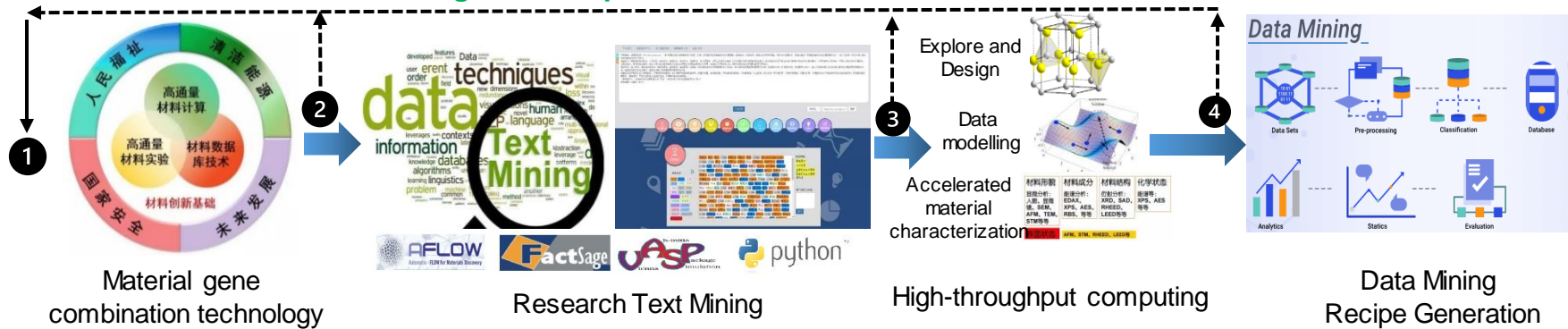
## 1, Data-driven material screening software platform

## 2, High-throughput intelligent hardware platform

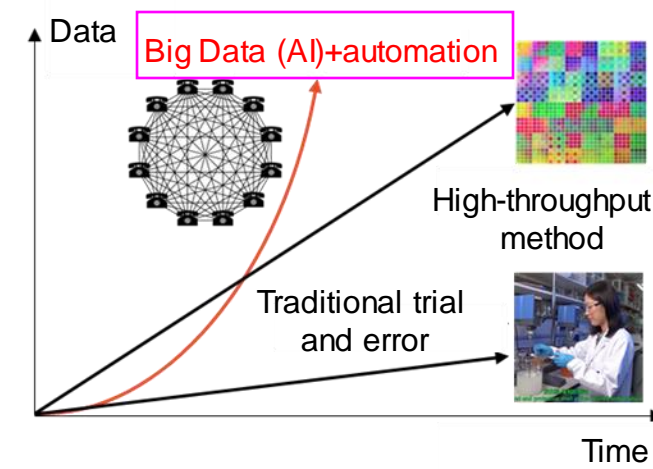
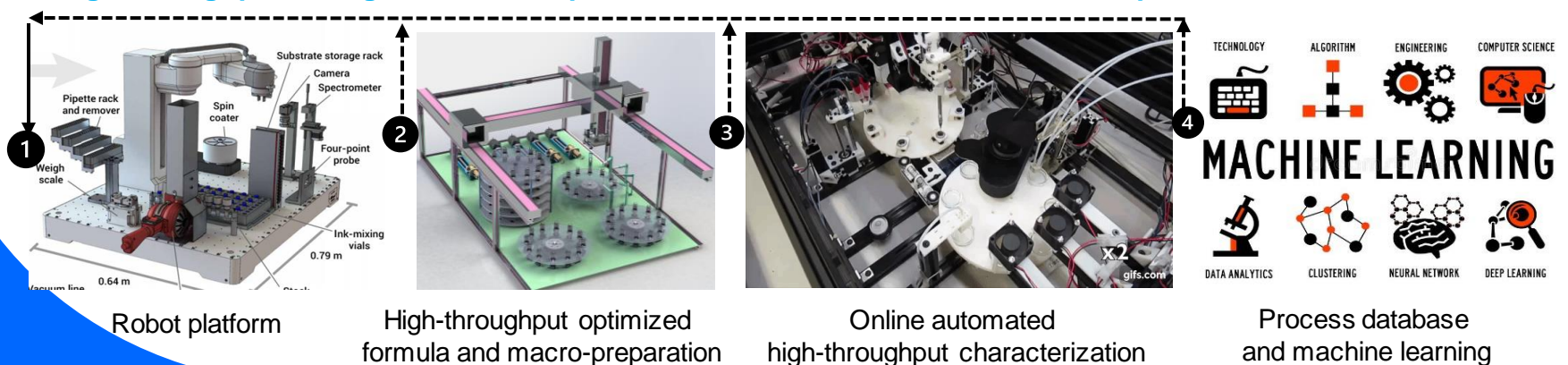
## 3, Online in situ characterization platform



### ➤ Data-driven material screening software platform



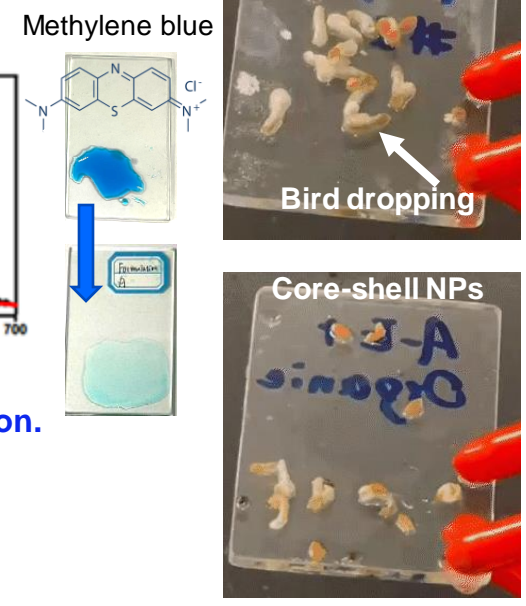
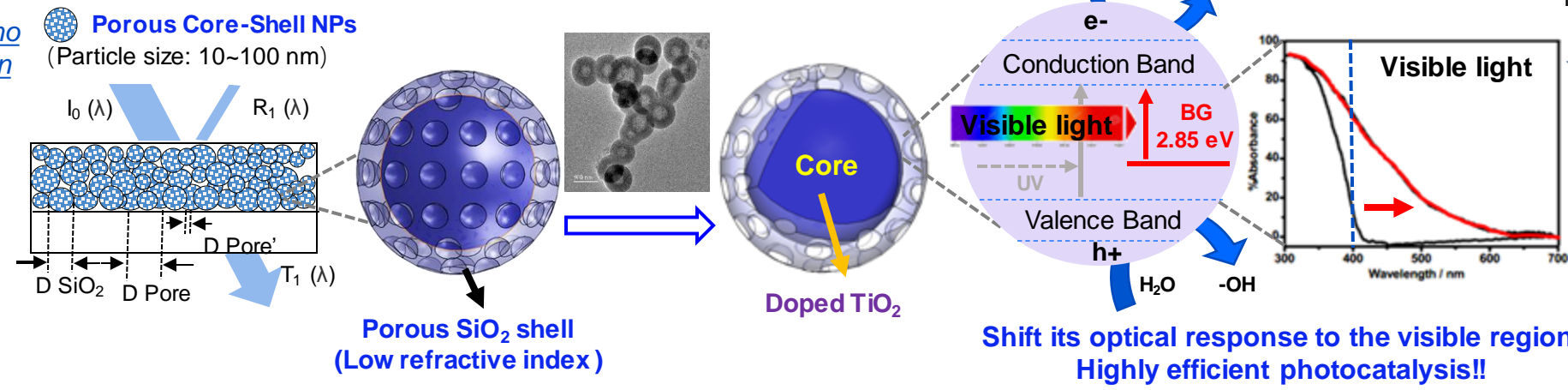
### ➤ High-throughput intelligent hardware platform & Online in situ characterization platform



# II. Our unique technology and innovations (2/2)

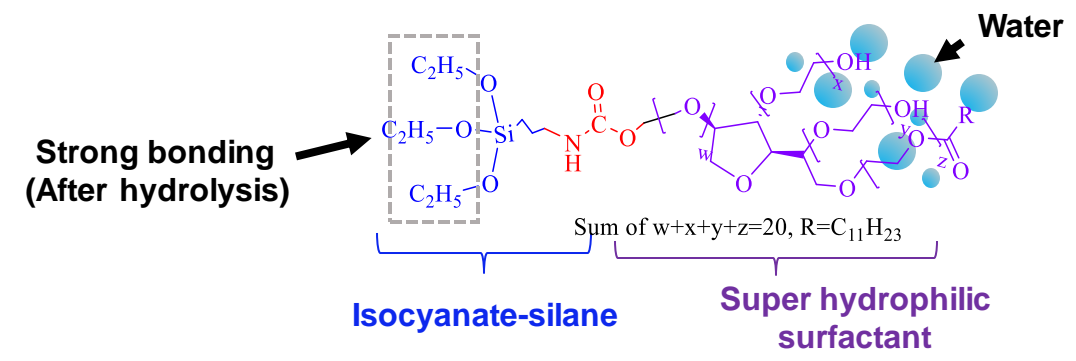
## Innovation 1:

Advanced nano encapsulation technique



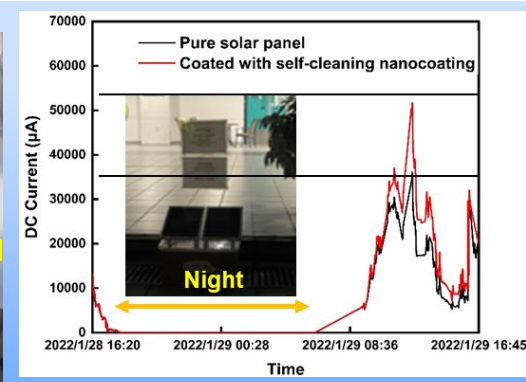
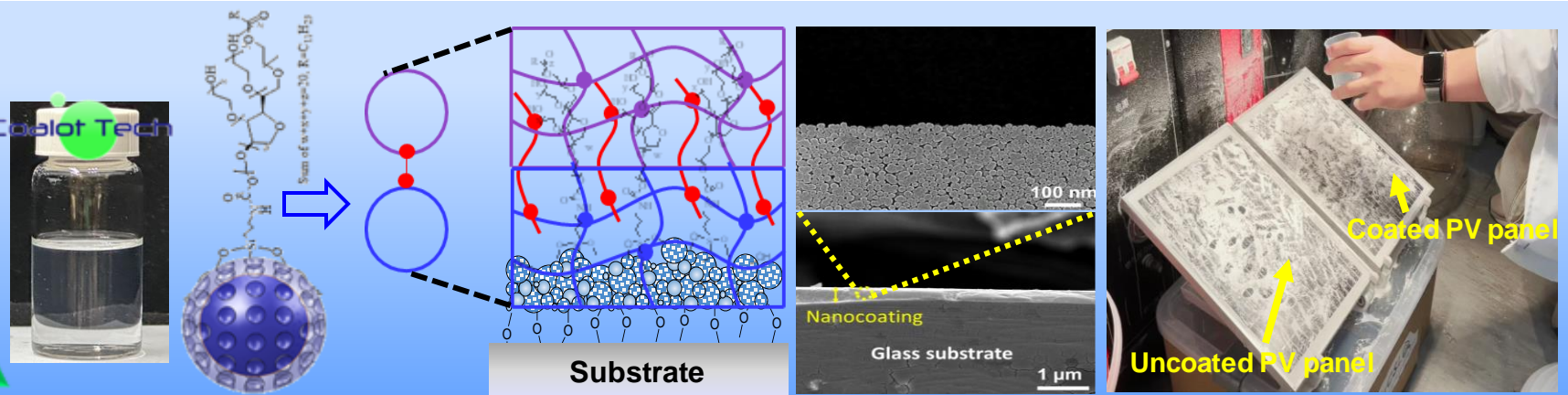
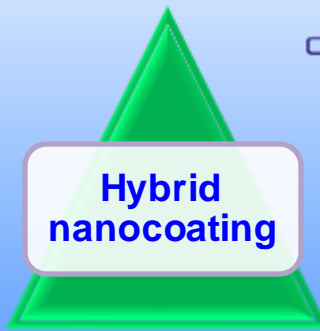
## Innovation 2:

Novel grafting technique



## Innovation 3:

Controllable topological technique



↑20% power generation eff. 6

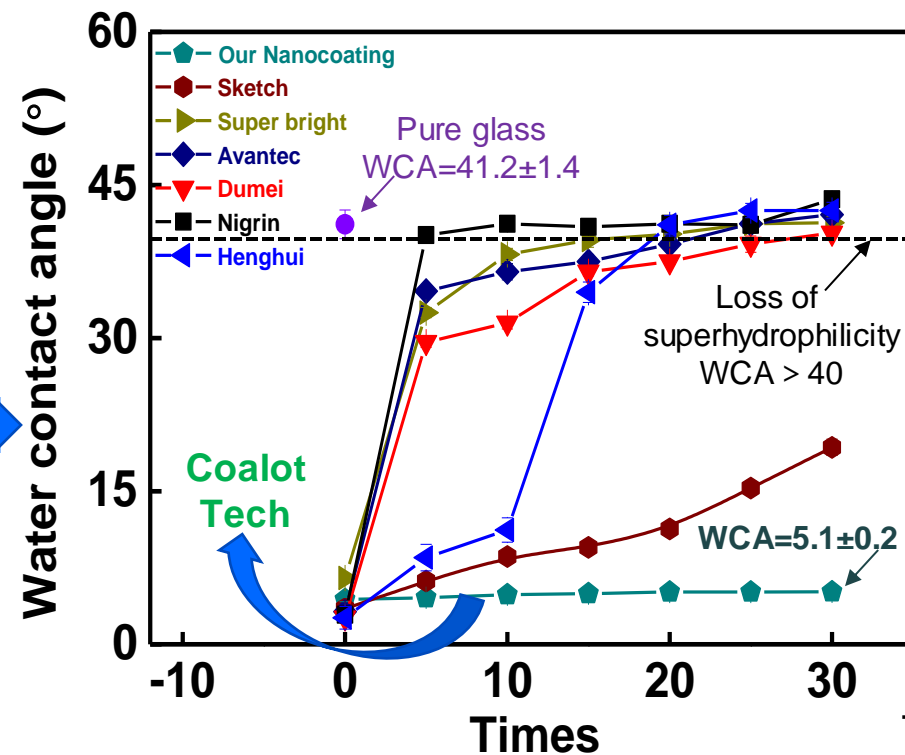
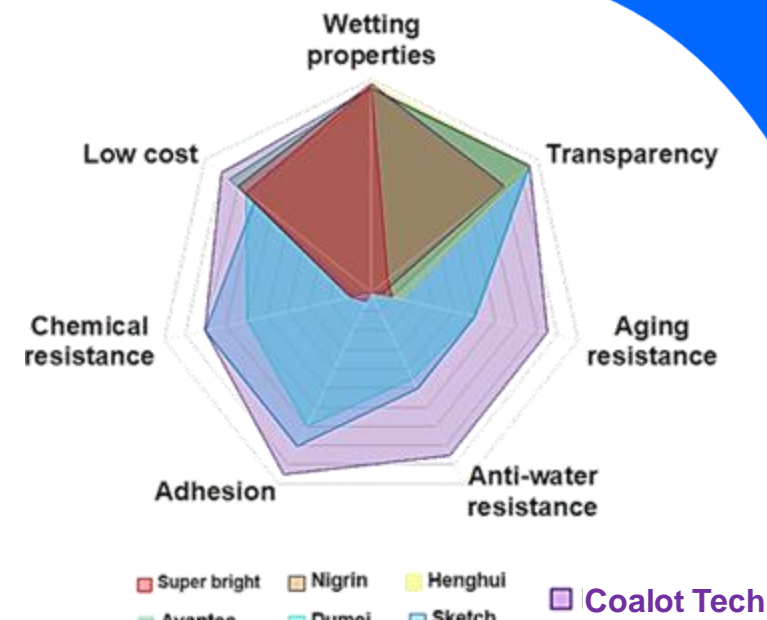
# II. Competition edge



	Avantec	Dumei	Sketch	Super bright	Nigrin	Henghui	Our product
Nation	U.S.	China	Japan	U.K.	Germany	China	China
Compon	Silica, TiO <sub>2</sub>	Silica	Silica	UV resin	TiO <sub>2</sub>	TiO <sub>2</sub>	Polymer + CS Nps
Curing Method	RT, air dry	RT, air dry	RT, air dry	60°C UV curing	120°C, 20mins	RT, air dry	RT, air dry
Photlisis	Only < 387 nm UV light	No	No	No	Only < 387 nm UV light	Only < 387 nm UV light	<ul style="list-style-type: none"> <li>• Shift its optical response to the visible region</li> <li>• Multi-functional (anti-bacterial, anti-frosting)</li> <li>• Superior anti-reflection</li> <li>• Great hydrophilicity</li> <li>• Easy curing method</li> <li>• Easy application (wipe or spray)</li> <li>• High transparency</li> <li>• Long lasting time (~24 months)</li> <li>• Eco-friendly and Cost-effective</li> </ul>
Demerit	<ul style="list-style-type: none"> <li>• Poor anti-aging ability</li> <li>• Poor anti-fogging ability</li> <li>• Poor anti-stain ability</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• No hydrophilicity after 70°C for 24h</li> </ul>	<ul style="list-style-type: none"> <li>• Short lasting time, could be washed away easily</li> <li>• Appearance peeling after 70h aging</li> </ul>	<ul style="list-style-type: none"> <li>• Pure anti-washing ability, short lasting time</li> <li>• Complex curing method</li> </ul>	<ul style="list-style-type: none"> <li>• Require high curing temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Require UV curing</li> <li>• High curing temperature</li> </ul>	

## Durable water flushing test results

Cost	755HKD/L (50-80m <sup>2</sup> /L)	1000 HKD/L (50-80m <sup>2</sup> /L)	800 HKD/L (40-70m <sup>2</sup> /L)	444 HKD/L (40-60m <sup>2</sup> /L)	889 HKD/L (30-50m <sup>2</sup> /L)	970 HKD/L (25-65m <sup>2</sup> /L)	~220 HKD/L (50-90m <sup>2</sup> /L)
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# II. Expanded applications and pilot applications

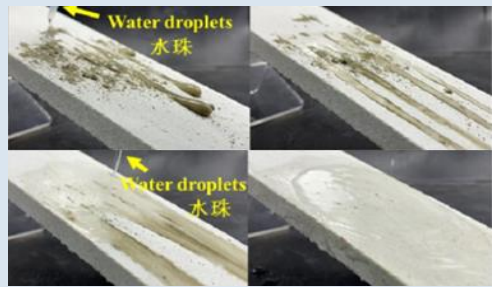
**\$500 B+,  
2022**

Glass curtain wall



**\$80-160  
/m<sup>2</sup>**

Building façade



**\$70 B+,  
2022**

Rearview mirror on car



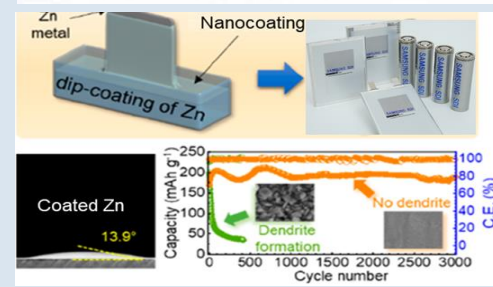
**\$26 B+,  
2022**

Bathroom mirror

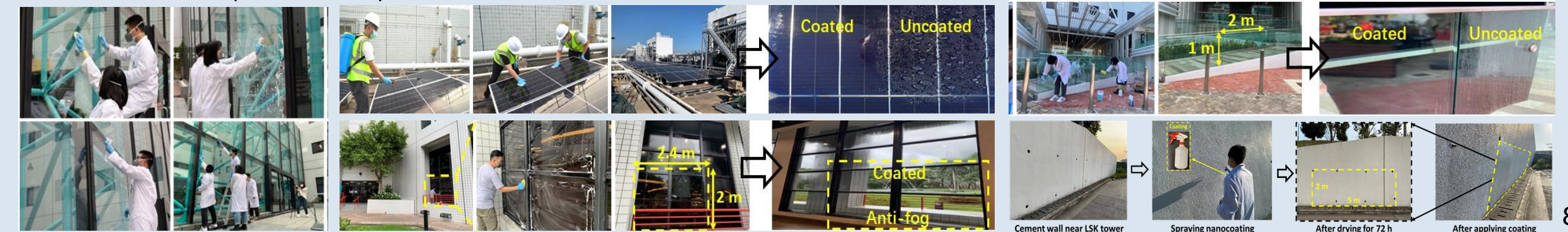


**\$20 B+,  
2022**

Zinc-ion batteries



➤ Pilot applications (~50-70 m<sup>2</sup>) in HKUST, 2020-2022 **\*Supported by \$1.03M Sustainable Smart Campus & \$0.7M Bridge Gap Fund, HKUST, 2020**





# III. Upcoming milestones on products and business developments

## April 2023

- ✓ Start-up establishment
- ✓ Enrolled TSSSU support scheme
- ✓ Crowdfunding, R&D development
- ✓ Manufacturing optimization
- ✓ **Small to pilot scale production (10 kg/ day to 100 kg/ day)**

## October 2024

- ✓ **Product launch**
- ✓ **Coordinate e-business applications**
- ✓ **Support B2B2C solutions**
- ✓ Foster holistically superior methodologies
- ✓ **>500L sales**

## October 2025

- ✓ Establish the brand's global reputation
- ✓ **> 5000L sales and making profit**
- ✓ **To become an emerging deep-green-tech startup unicorn**

Stage I Validation: Vision/Founders/Product fit

Stage II Growth: Business model/Market fit



- ✓ **OEM & ODM & OBM**
- ✓ **Synergize scalable commerce**
- ✓ Build the supply chain
- ✓ Disseminate standardized metrics
- ✓ **>100L sales**

## April 2024

- ✓ Deploy strategic networks with leading industries & e-business needs
- ✓ **Access profitable revenue streams**
- ✓ **Angel investment**
- ✓ **> 1000L sales**

## April 2025



Collaboration with industries



Team Intro

# Thanks for your support!



*Application cases:*



Car rearview mirror



Glass curtain wall











Solar panel

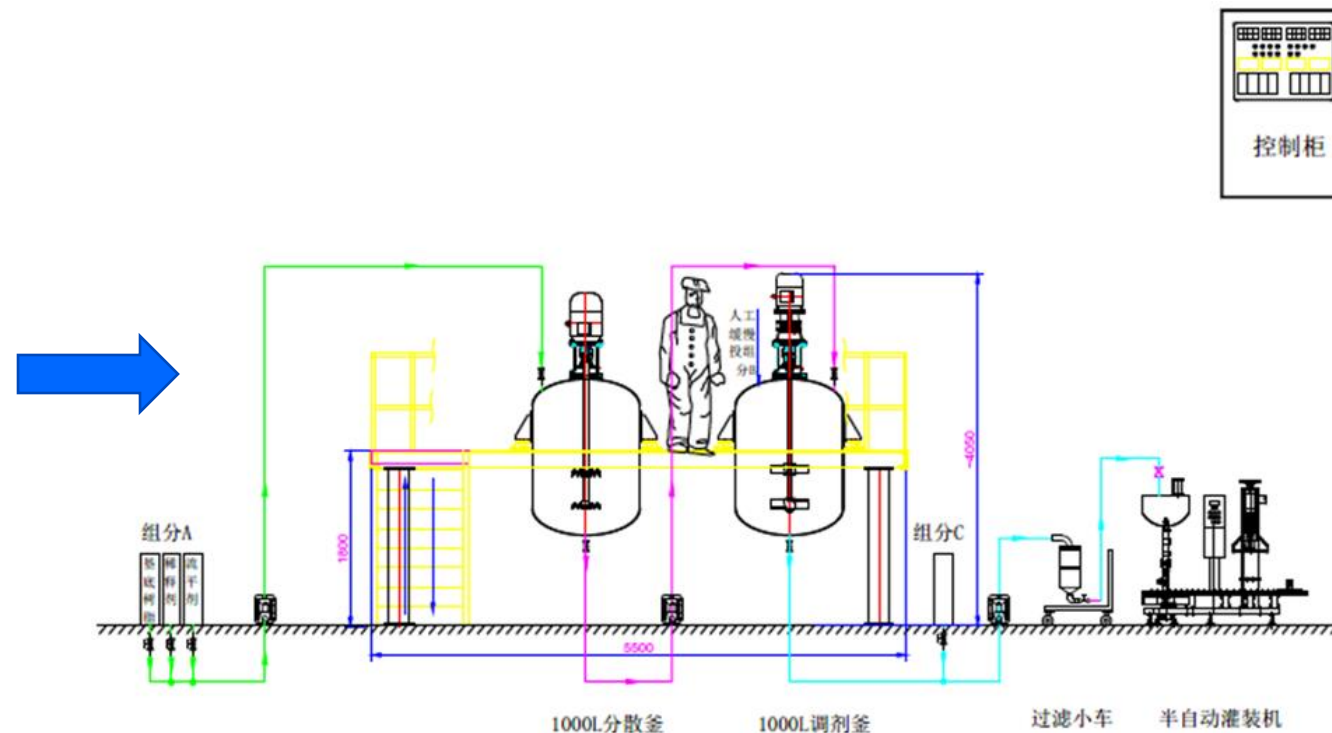
# Appendix

# Planning of mass production line

Daily 10 kg Mass production in the lab (equipment line)

N	Eqpt/ Small tools	Name	Quantity	N	Eqpt/ Small tools	Name	Quantity
1		Ultrasonic processor and its enclosure (Brand: VC-750)	1 pc	5		IKA EUROSTAR 60 Digital Stirrer OS40-PRO Universal plate stand (WxDx:20x31 cm) including support holder (H:78cm) and fixing device Crossed stirrer S.S. shaft length 40cm stirrer diameter 5 cm	1 pc
2		10 points digital magnetic hotplate stirrer (Brand: IKA RT10)	1 pc	6		Fume hood with DI water and Nitrogen gas	1 set
3		Three-necked flask, 2000 ml	1 pc	7		Water/oil bath	1 pc
4		Condenser tube	1 pc	8		Heating table	1 pc

Daily 2-ton Mass production (equipment line)



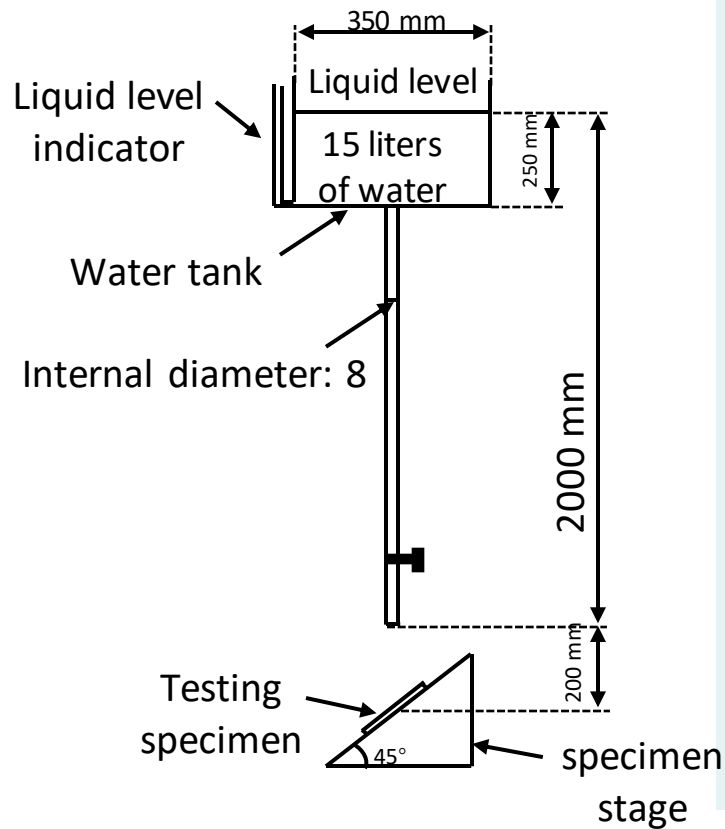
# Business plan and milestone

01/04/2023-31/03/2024

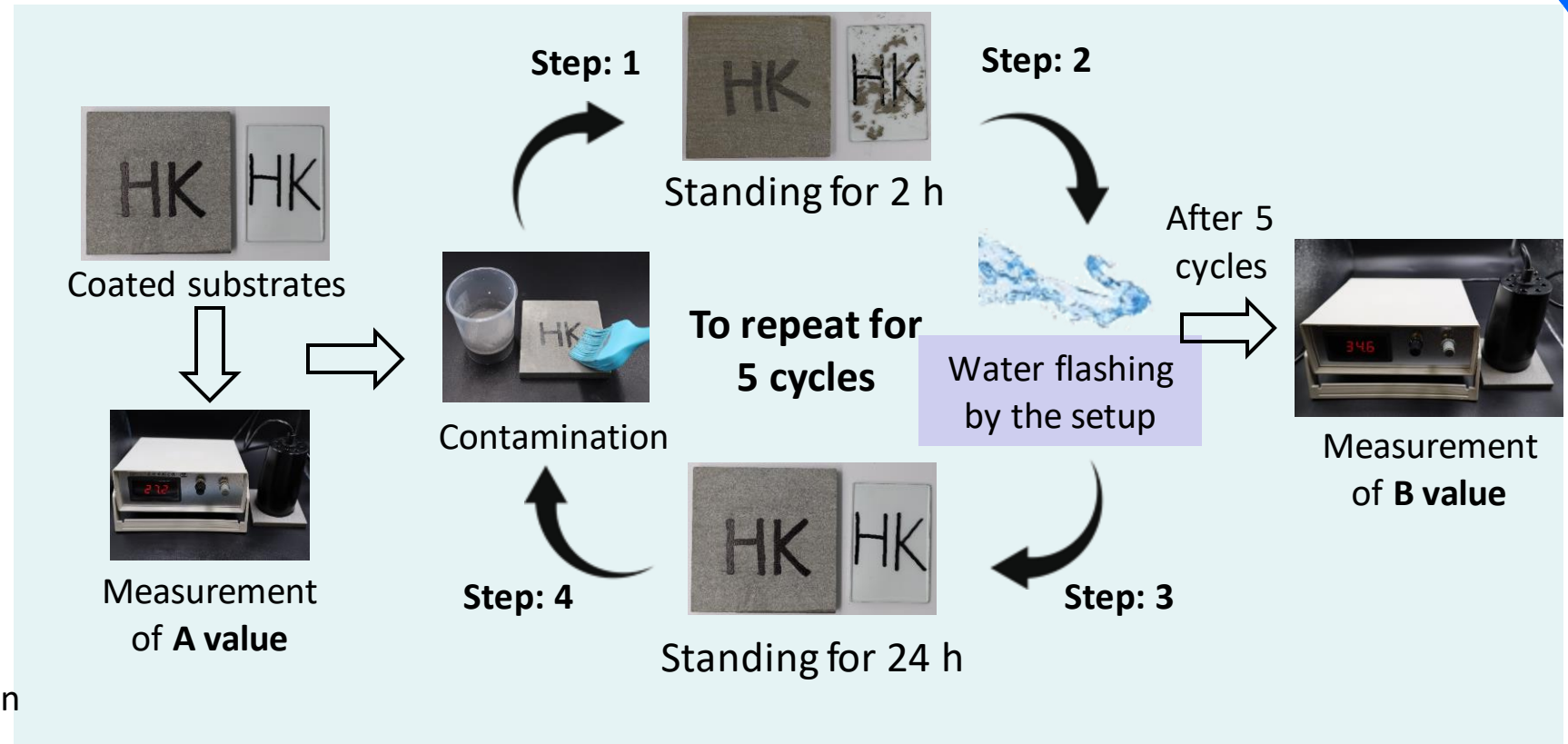
	Deliverables	Milestones 1				Milestones 2				Milestones 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>I.</b> <b>Business activities</b>	<i>Board recruitment</i>												
	<i>Purchase of repair and installation tools and equipment</i>												
	<i>Purchase of the needed raw materials/safety protection and treating equipment/machines;</i>												
	<i>Purchase of the needed furniture, office equipment, software applications, electronic appliances, and facility facelift</i>												
	<i>Creating awareness for the business</i>												
	<i>Establishing business relationships with vendors and key players in the supply chain and treating industries</i>												
	<i>Generating part of business relationships from the founders (financial projection)</i>												
	<i>Securing a standard workshop facility for our business</i>												
	<i>Creating an Official Website for the business</i>												
	<i>Drafting of Employee's Handbook</i>												
	<i>Opening of Corporate Bank Accounts in various banks in Hong Kong</i>												
	<i>Opening Online Payment Platforms</i>												
	<i>Application and Obtaining Taxpayer's ID</i>												
	<i>Application for business license and permit</i>												
	<i>Purchase of All forms of Insurance for the business</i>												
	<i>Health and Safety and Fire Safety Arrangement</i>												
	<i>Drafting of Contract Documents</i>												
<b>II.</b> <b>R&amp;D tasks</b>	<i>Optimization formulation of a highly transparent, AR, and durable self-cleaning nanocoating with finalized hybrid components</i>												
	<i>Quantitative evaluation of effectiveness of the nanocoating to save-labour/ energy in wide application used; To obtain third-party product certification, etc.</i>												
	<i>An innovative scaled-up self-cleaning nanocoating for fenestration systems, building envelopes, PV panels, etc for public demonstration. and quantifiable life cycle analysis of sustainably grade material</i>												
	<i>Product promotion, commercialization of mass production</i>												

# Performances of Hybrid Nanocoating (1/2)

## ➤ Characterization of self-cleaning test process



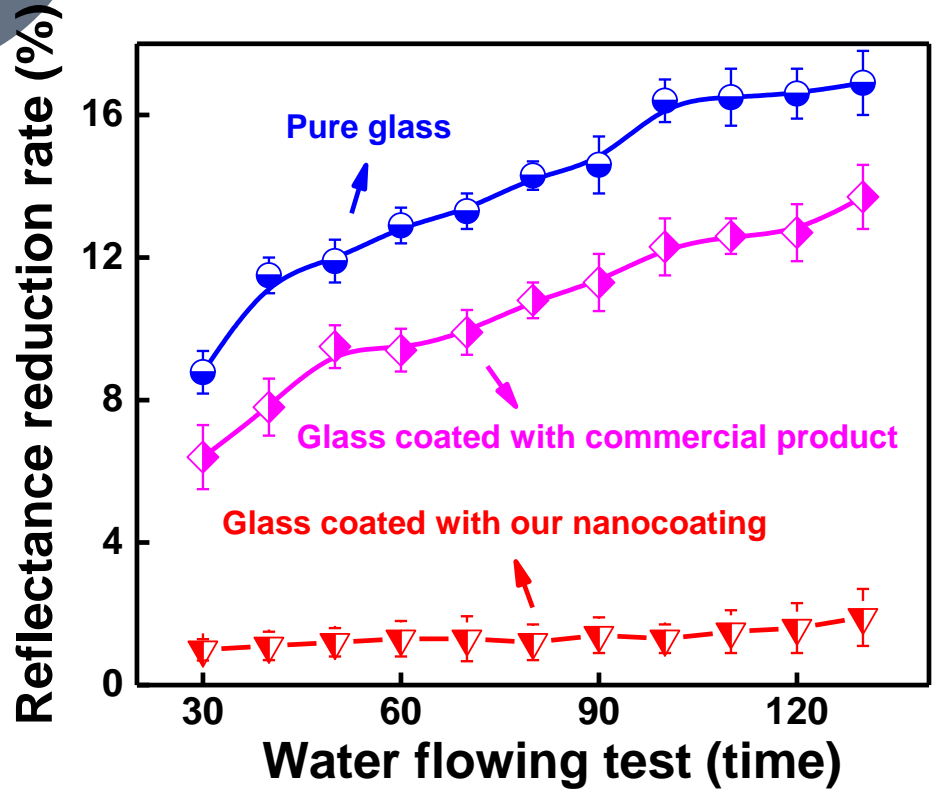
Water flashing testing setup



$$\text{Reflectance reduction rate \%} = \frac{|A-B|}{A} \times 100\%$$

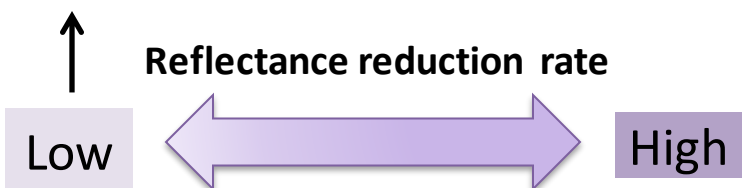
where Reflectance reduction rate % is the decrease rate of reflection coefficient about the testing specimen.  
*A* is the initial average reflection coefficient of the testing specimen,  
*B* is the average reflection coefficient of the test specimen after the anti-stains test.

# Performances of Hybrid Nanocoating (2/2)



The relationship of the coated surfaces between water flowing test time and reflectance reduction rate

Less stain found in the surface



## Visual test results

