APPROACH

Advanced, economical, and eco-friendly synthesis route for photochromic functional glasses

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IESL-FORTH

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OUTLINE

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- The Solution – Research Innovation
- Impact
- Call to Action

The Problem & Opportunity

Glass is widely used in many aspects of modern life: windows flat glass, glass containers, fiberglass, transportation, optoelectronics, and other.

A global manufacturing market size of almost **300 billion USD is estimated for 2024**.

The scientific challenge: a huge bottleneck in the fabrication of glasses **lies on the necessity of high-temperature (high-T) melting procedures, often >1200 ^{o}C**.

The typical high-T methods pose three important disadvantages:

1. Expensive while leaving heavy environmental footprint.
2. Renders impossible the incorporation of many functional materials, i.e. not able to sustain high-T melting, thus limiting their potential towards modern applications.
3. Even if the desired materials can sustain the high-T protocol, the spatial positioning inside the glass is entirely uncontrolled.

The Solution – Research Innovation

The innovative post-melting encapsulation (PME) solution:

The developed **low-T PME technology** resolves simultaneously the drawbacks of the typical high-T melting operations.

Beyond the current state-of-the-art (SOA):

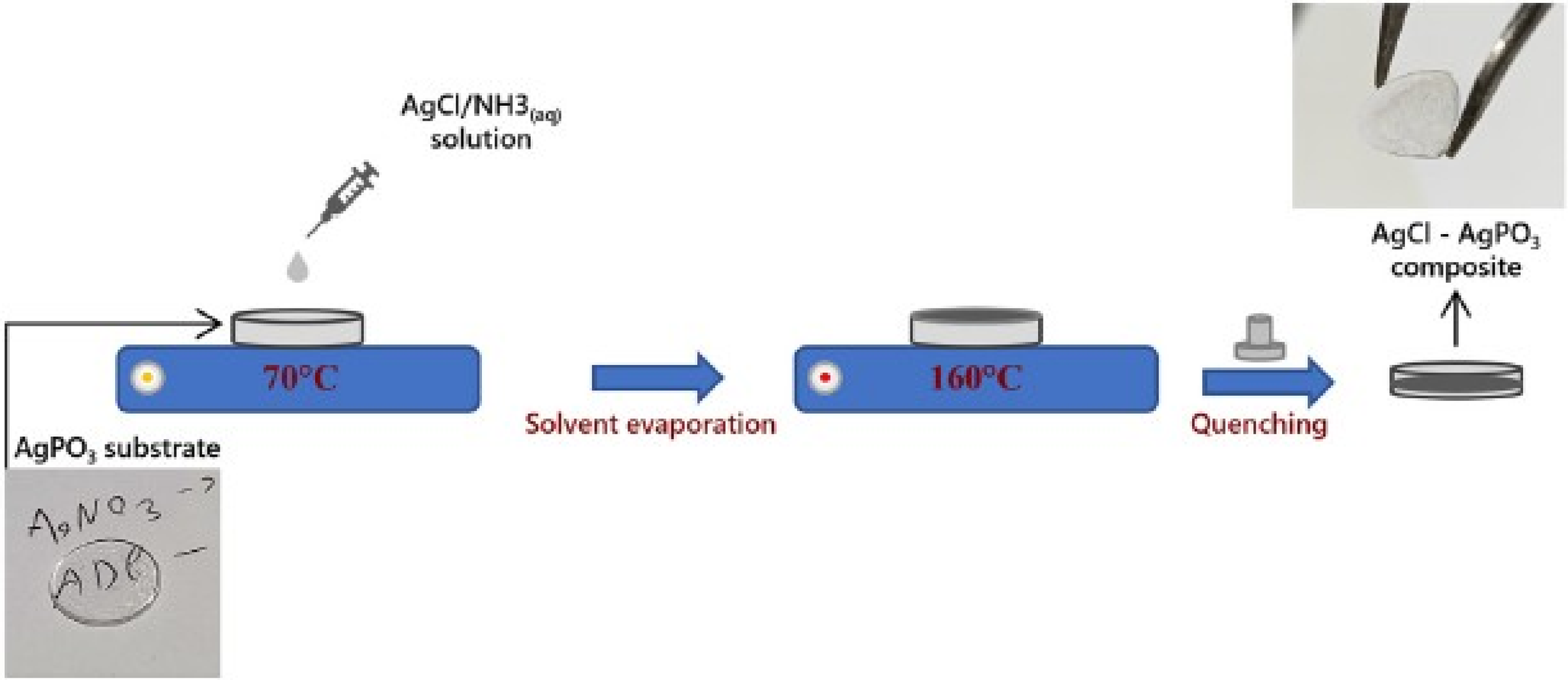
1. It allows the incorporation of functional materials within transparent glasses **below 190 °C, i.e. being cost-effective with minimal environmental footprint.**
2. Renders **possible** the incorporation of temperature sensitive functional materials inside glass.
3. It provides a **controlled way of positioning materials** and functional layers within glasses.

➢ The combination of these breakthrough solutions exceeds the current SOA when it comes to the fabrication of functional transparent glasses **with enormous potential towards next-generation applications and new markets**.

The groundbreaking PME synthesis opens new ways towards fast, feasible, cost-effective, and environmentally friendly fabrication of advanced glasses for a wide

The Solution – Research Innovation

The innovative post-melting encapsulation (PME) solution:



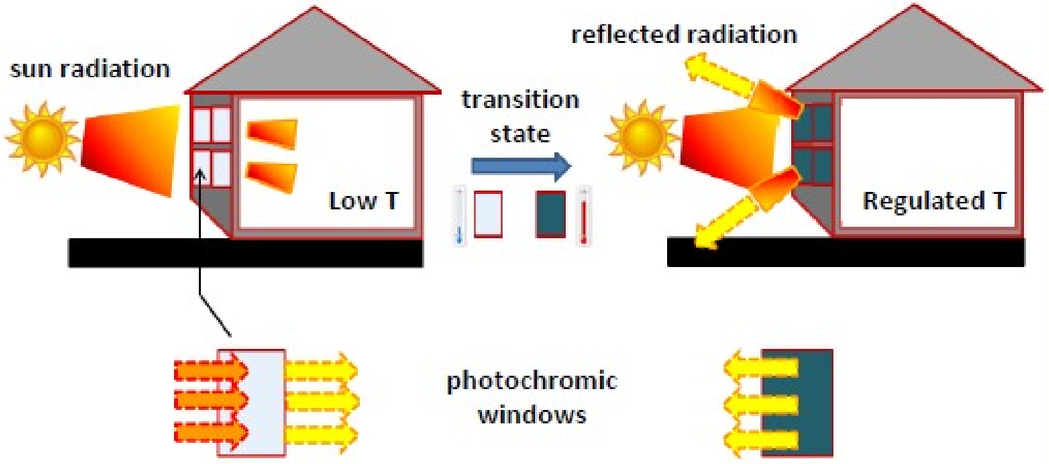
The Solution – Research Innovation

Indicative eco-friendly green applications

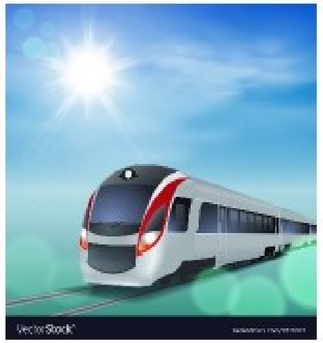
Photochromic glass windows for green buildings and vehicles

Energy saving and greenhouse gas emission reduction by self-sustained and wirelessly monitored interior temperature regulation of Green Buildings and Smart Vehicles

Buildings



Public transport vehicles



Impact

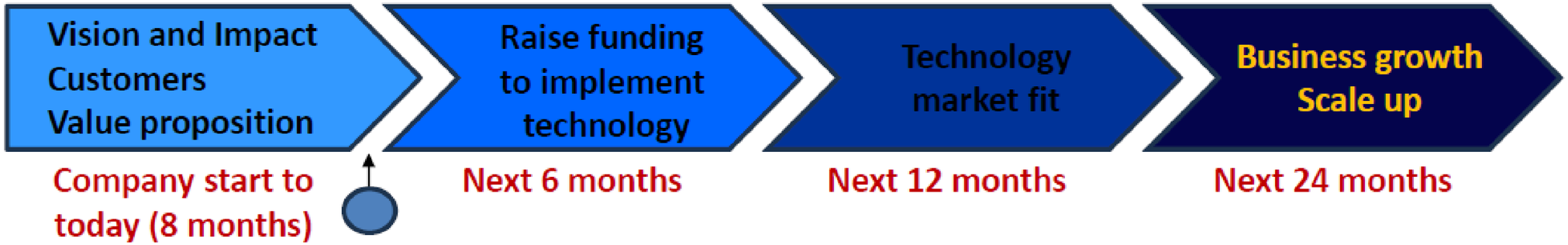
Technology	Temperature	Energy consumption*	Environmental footprint*	Key features
Typical melting High-T (current SOA)	> 1200 °C	11.6 GJ/t_{Glass} 605 Euros/t_{Glass}	PR CO_2: 190 (kg_{CO2}/t_{RM}) ER CO_2: 337 (kg_{CO2}/t_{Glass})	Limited availability of photochromic materials Uncontrolled incorporation Higher amount of photochromic material/glass sq. m.
Low-T PME by IESL-FORTH (beyond SOA)	< 190 °C	7.4 GJ/t_{Glass} 387 Euros/t_{Glass}	PR CO_2: 122 (kg_{CO2}/t_{RM}) ER CO_2: 216 (kg_{CO2}/t_{Glass})	Multiple selection of functional materials Reduced amount of photochromic material/glass sq. m. Controlled incorporation Controlled degree of immersion Patterns formation

Market potential:

The flat glass manufacturing global market size was of about **287 billion USD last year**, whereas it is anticipated to reach over **380 billion USD in 2030.**

Europe alone holds around 1/5 of this market, **i.e. 57 billion USD (2023) and 76 billion USD (2030)**.

Call to Action



Vision: Photo-chromic glass making requires high temperature procedures. Our innovative technology allows fabrication at low-temperatures with economic and environmental benefits.

Customers: Glass manufacturers, building operators and owners.

Value proposition: Reduce production cost and increase installation in next-generation energy efficient Green-Buildings and vehicles.

Funding: Raise funding for technology optimization and sustaining the start up until business growth (1000 K Euros).

Technology market fit: Determine and disseminate the benefits of implementing the novel technology.

Business growth: Produce glass at an industrial scale. Advertise the photo-chromic windows for scaling up the implementation towards reducing consumption of electricity, while minimizing environmental pollution.

Scale up: Target the 57 billion USD European glass manufacturing market.

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THANK YOU

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