

# ALD coated bactericide/virucide stickers

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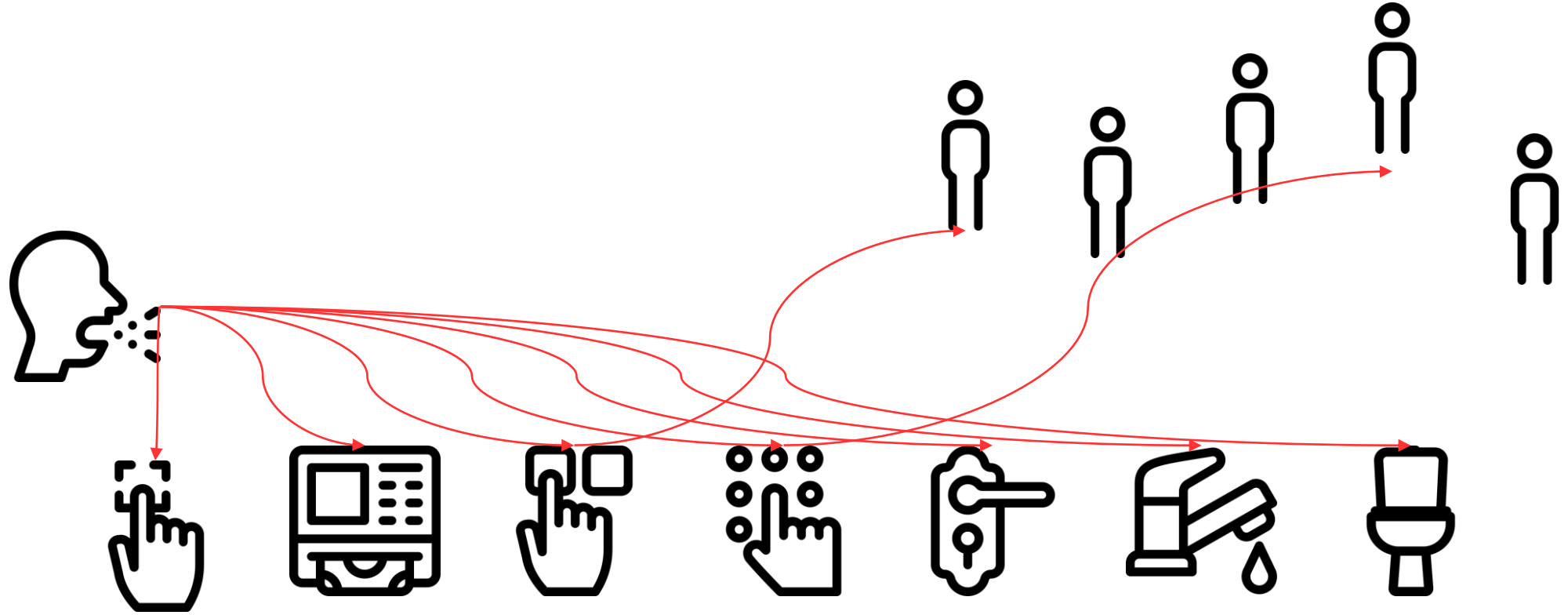
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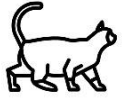


# Problem Being Solved

## Propagation of infectious diseases through surfaces



SARS-COV-2 (COVID) , antibiotic resistant bacteria, NBC/ bioterrorism,....

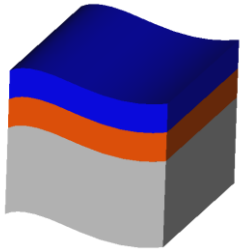
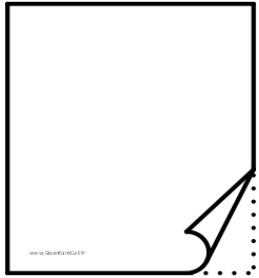


# The Quantum Cat Solution



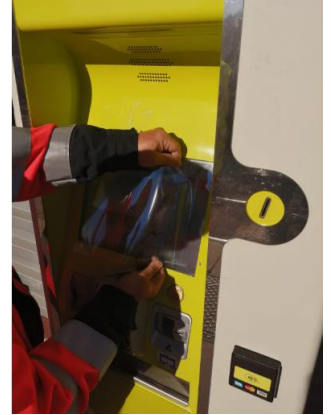
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## Protective Transparent sticker with an active coating



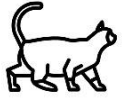
- Simple and easy application
  - Application on existing equipment
  - No training required for personnel
- Consistent protection against microbiological contamination
  - More protection than periodic wet chemical disinfection
- Ecofriendly
  - Stickers can be recycled
  - Avoid dispersion of biocide products in environment
- Versatile
  - Application determined by end users

## Touch Screens



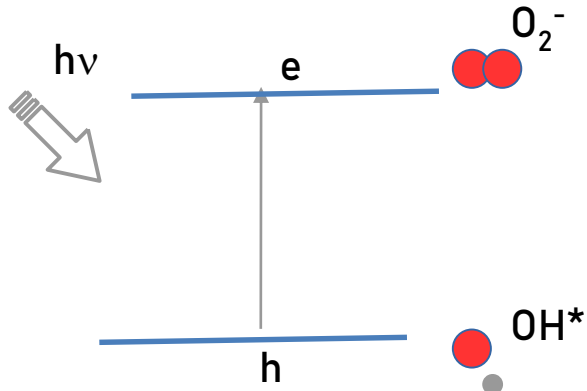
## Electrical Buttons





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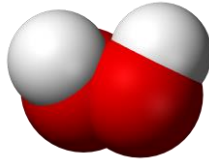
# Microscopic Mechanism



Synthetic oxide semiconductor

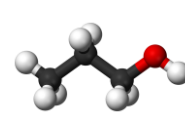
Light induced charge carriers cause generation of Reactive Oxidant Species (ROS) at exposed surface

Atmospheric water vapor is transformed in hydrogen peroxide



Catalytic Mechanism,  
The coating is not consumed in the process

Simple molecules are combusted



Microbiological objects are neutralized



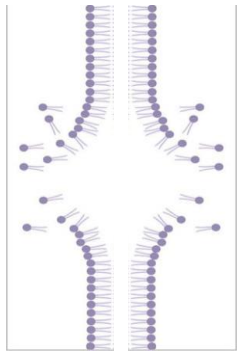
Virucide

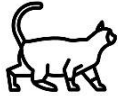


Bactéricide



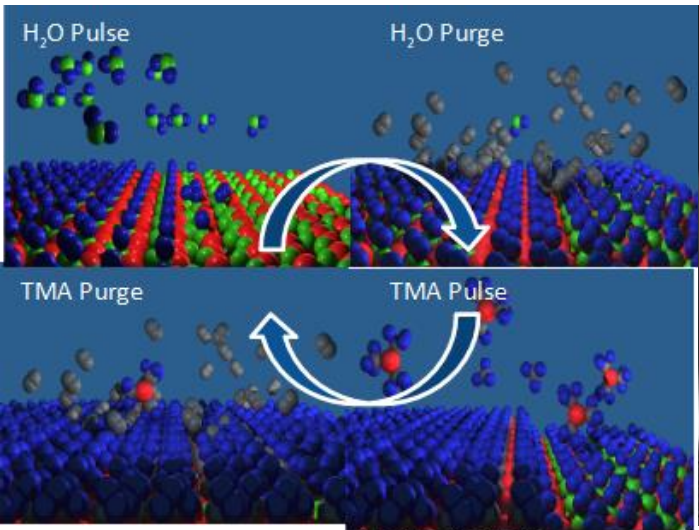
Fungicide



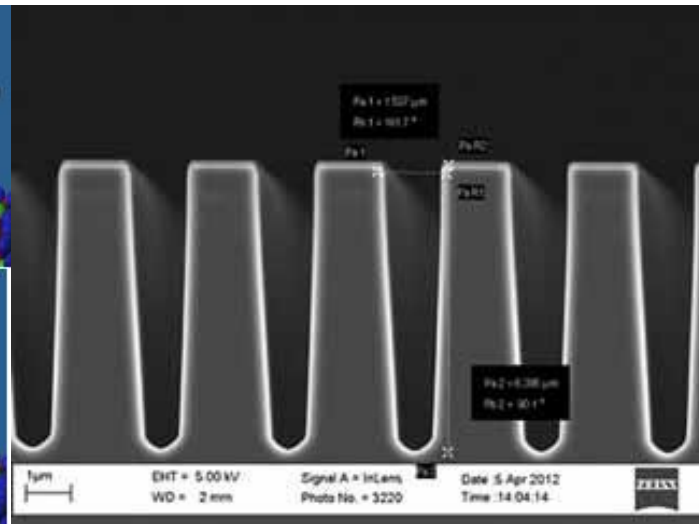


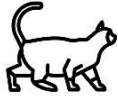
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# Atomic Layer Deposition/Encapsulix



1.1 Angstroms/ cycle





# Materials Development : Optimizing Quantum Efficiency



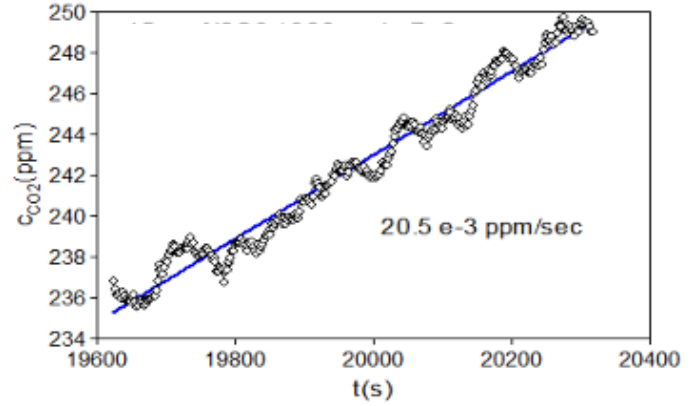
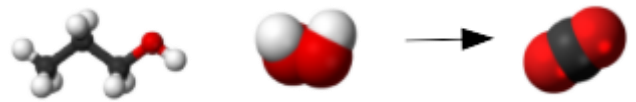
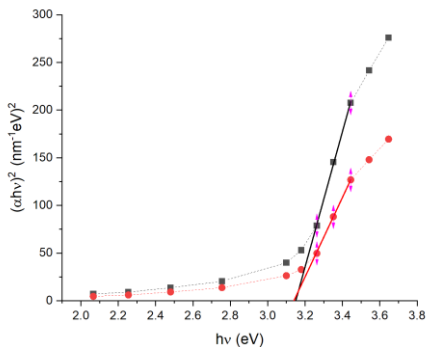
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Oxide semiconductor with band gap around 3.2eV  
Transparent in visible, highly absorbing UV-A

Quantum Efficiency  $\eta$  of the photocatalytic process = number of OH radicals created per photon

Relative measurement :

1. Expose sample to water vapor, Isopropanol vapor and photon flux in vacuum chamber
2. Measure increase of CO<sub>2</sub> concentration
3. We measure  $\eta \cdot \xi = 0.65\%$ , where  $\xi$  = reaction probability fo IPA molecules with OH





# Virucide action against Coronavirus

## Test according to ISO 21702 by independent laboratory



### TEST ISO 21702



Prepare inoculum  
Human Coronavirus 229E



Expose plastic



Cell Culture to determine  
percentage of virus capable of  
infecting cells

### Results

On untreated surfaces, this virus is neutralized at a rate of one decade per 2.5 days ( i.e. 90 % after 2.5 days, 99 % after 5 days etc)

On QC samples, there is a reduction by **99,82% in 1 hour**



# Bactericide Action ISO 27 447 with E Coli



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## TEST ISO27 447



Prépare inoculum  
Bacteria E Coli



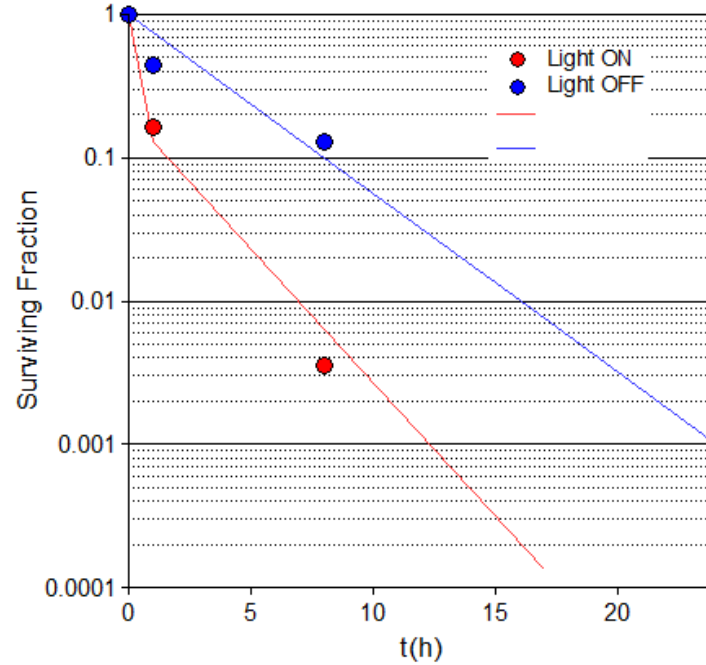
Expose plastic



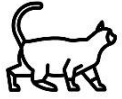
Observation nr bacteria



## RESULTS



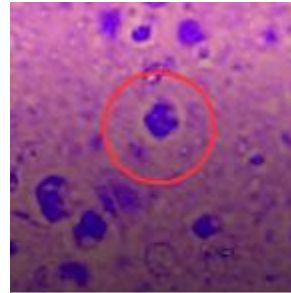
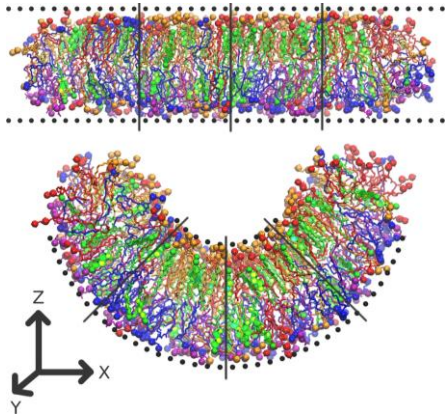




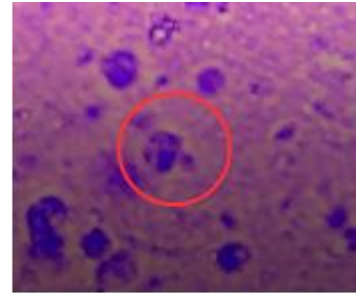
# Mechanism of neutralization of microbiological agents

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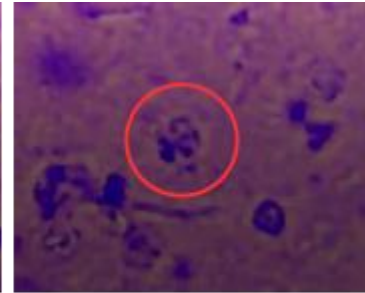
Reactive species cause deformation of bilayer lipid cell membrane  
(« Blebbing »)  
This leads to local breaching of membrane and escape of cell contents



t=45 s  
Cell is intact



t=4 minutes  
Cell membrane breached  
Some material escaping



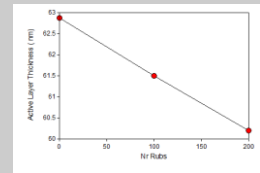
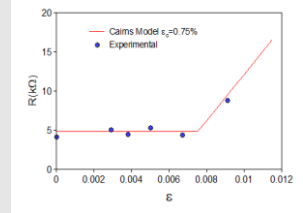
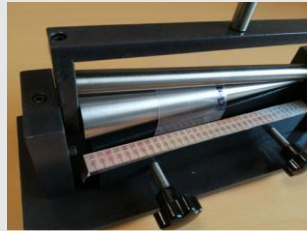
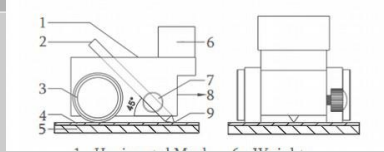


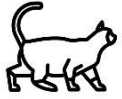
# Durability



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Mechanism	Method	Result
Scratches	ASTM D 3363 – 05 UV microscopy	No scratches for hardness H (~ humain fingernail)
Delamination	ASTM D 522 – 93a Microscopie UV Photoconductance Photospectrometrie	No mechanical damage for bending radius > 2.5 mm
Wet Rubbing	ASTM D6279 Microscopie UV Ellipsometrie Spectrale Photospectrometrie Reflectometrie	90 % efficiency after 2500 rubs with alcohol





# Real Life Testing

## Esthetics



## Stability in time

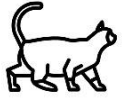


t=0



t=50 days





# Take Away Points and Outlook



**Encapsulix has developed the Quantum Cat protective sticker technology**

Highly efficient protection against variety of microbiological contaminants

Greener, more effective , cost effective alternative to wet chemical disinfection

**Commercial Roll out has started**

CE certification in place

Pilot projects with early adapters ongoing

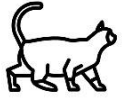
Leading actors in public transport, aeronautics, healthcare

Existing pilot line ; Manufacturing Capacity Scale up

**Opportunities for academic collaborations**

New materials for improved efficiency, reliability

Manufacturing Science and Technology



# Discussion