



Electrodynamic Systems & Technologies

**NOVELL**

**COLD ATMOSPHERIC PLASMA  
TECHNOLOGIES & EQUIPMENT  
FOR MATERIAL AND ITEMS  
STERILIZATION, ACTIVATION,  
MODIFICATION & CONVERSION**

**ANATOLY N. MALTSEV**

**CEO of EST, LLC**



# Electrodynamic Systems & Technologies

## NOVELL COLD ATMOSPHERIC PLASMA TECHNOLOGIES & EQUIPMENT

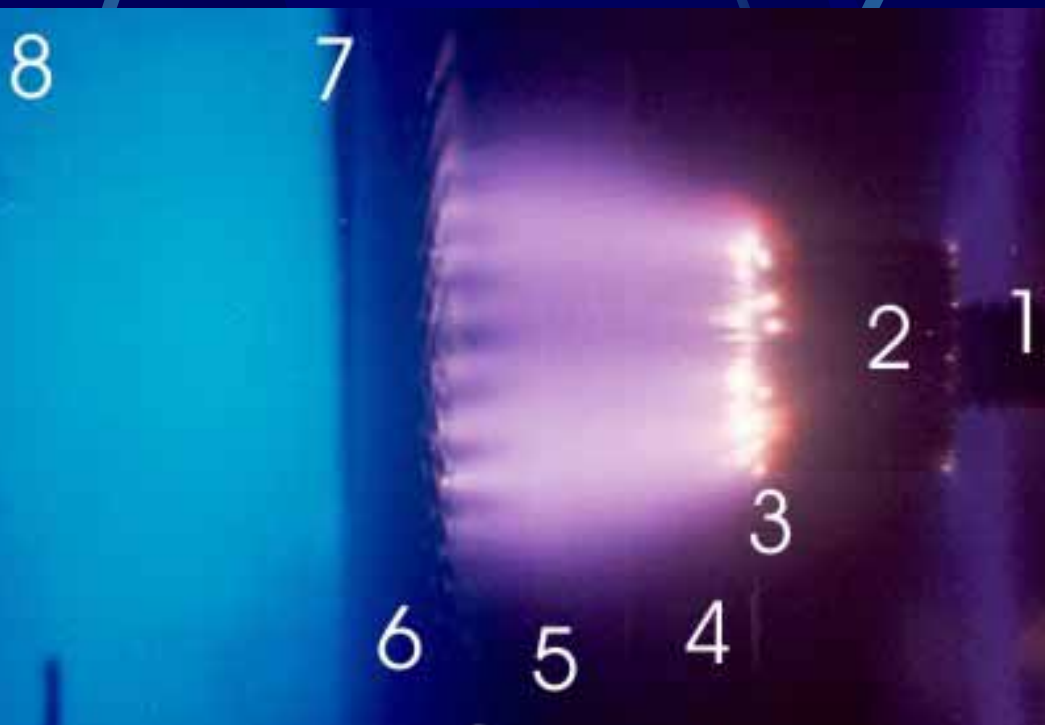


**Established at May, 2007**  
**30 staff**  
**450 m<sup>2</sup> working area**



# Electrodynamic Systems & Technologies

## NOVELL COLD ATMOSPHERIC PLASMA TECHNOLOGIES & ATMOSPHERIC DISCHARGE WITH RUNAWAY ELECTRONS - ADRE MAIN PHYSICAL PRINCIPLES



First Patent for DRE  
in dense Gas

A. N. Maltsev  
2274923, 2003



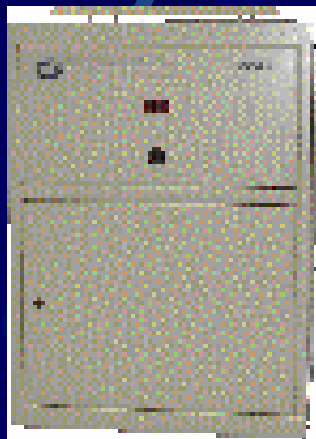
Electrodynamic Systems & Technologies

**NOVELL COLD ATMOSPHERIC  
PLASMA TECHNOLOGIES &  
HIGH-VOLTAGE PULSE GENERATORS  
EQUIPMENT  
PROTEUS FAMILY**

**Proteus-L**

**Proteus-I**

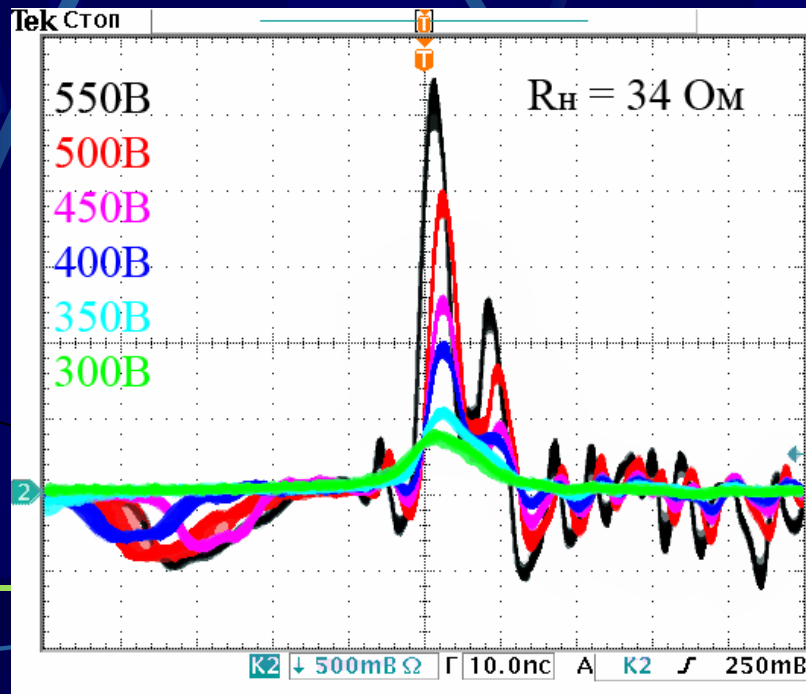
**Proteus-II**





# Electrodynamic Systems & Technologies

## NOVELL COLD ATMOSPHERIC PLASMA TECHNOLOGIES & HIGH-VOLTAGE PULSE GENERATORS PROTEUS FAMILY Proteus-III



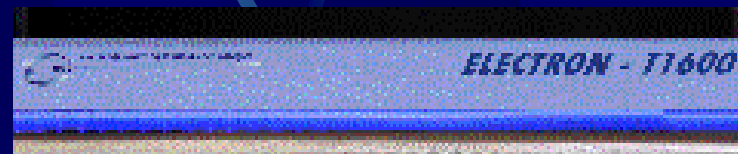


# Electrodynamic Systems & Technologies

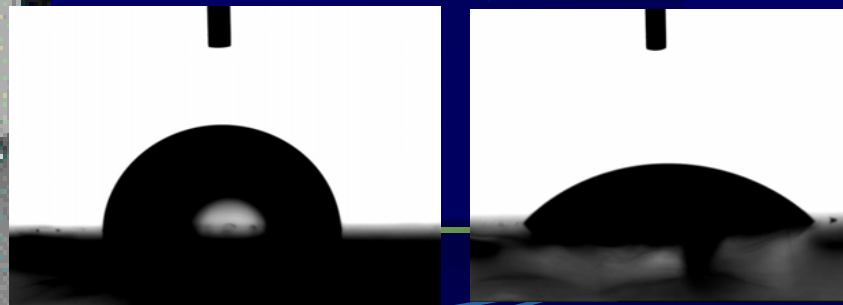
## NOVELL COLD ATMOSPHERIC PLASMA TECHNOLOGIES & ATMOSPHERIC PLASMA GENERATORS EQUIPMENT ELECTRON FAMILY



The ADRE-plasma tunnel  
 $1600 \times 60 \times 60 \text{ mm}^3$



The improvement of  
wettability

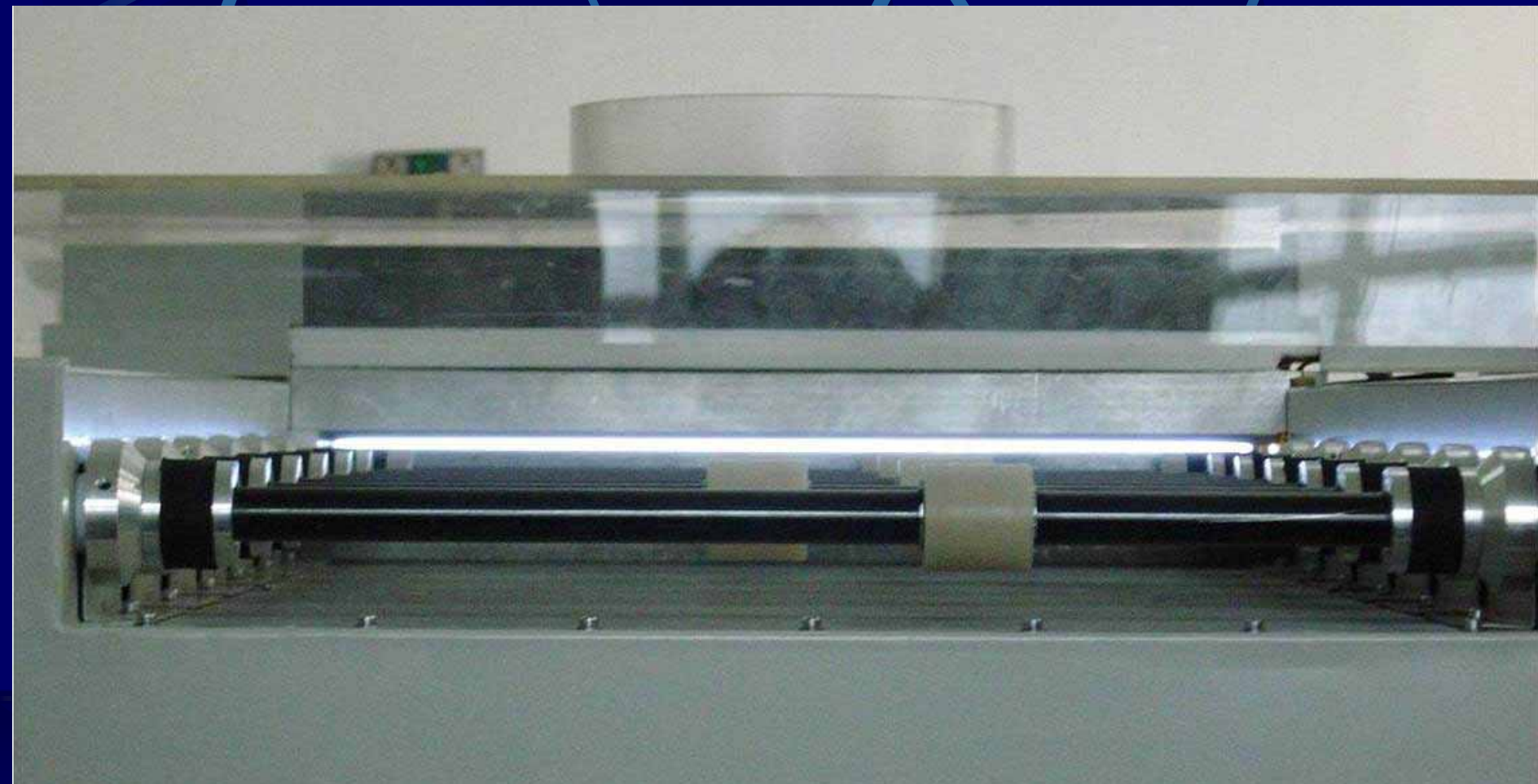






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Atmospheric pressure plasma tunnel  
for solid-state surface activation & modification



## Results of ADRE-plasma treatment for FPD glass substrates

● Before Plasma treatment

After Plasma treatment





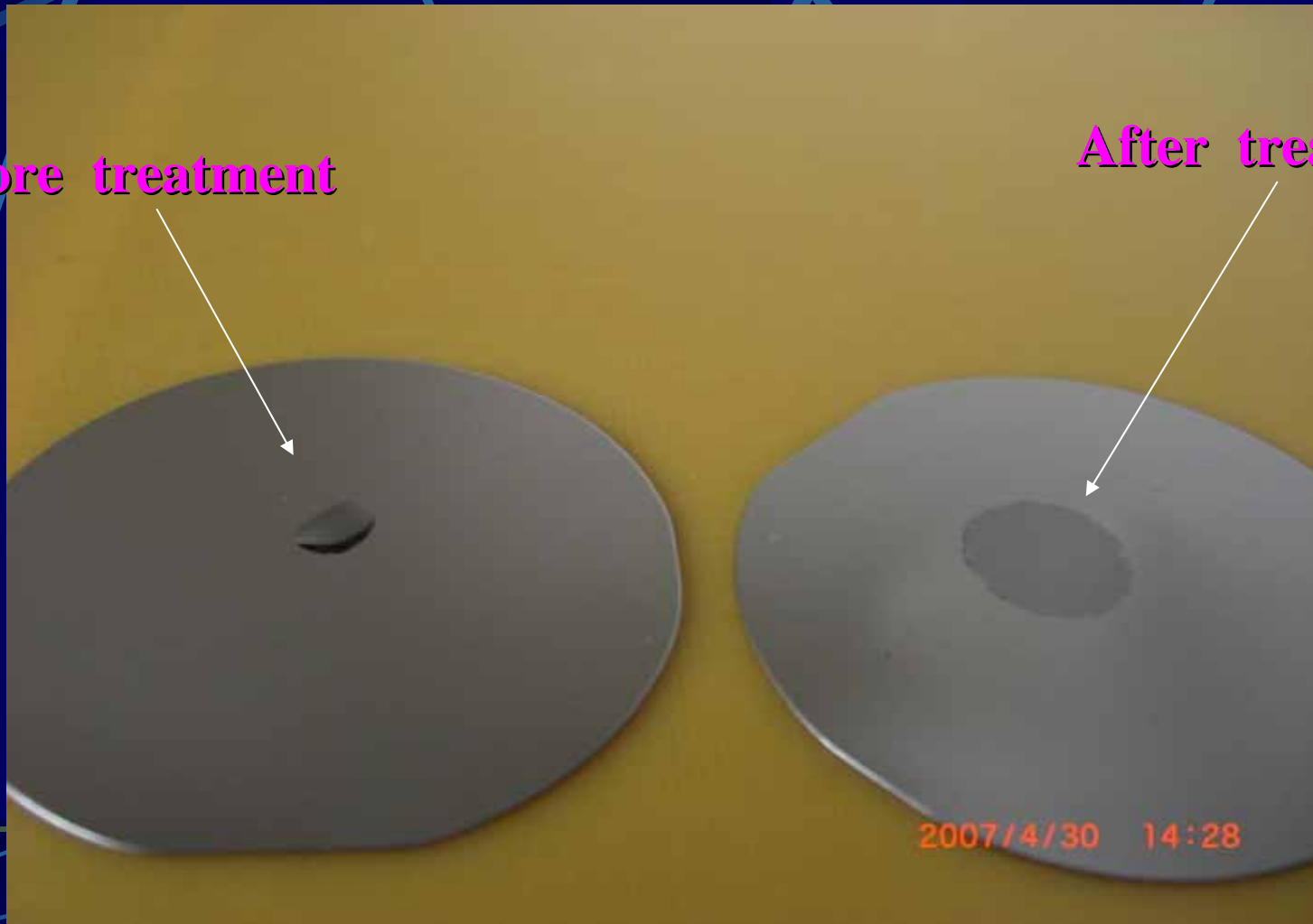


# Electrodynamic Systems & Technologies

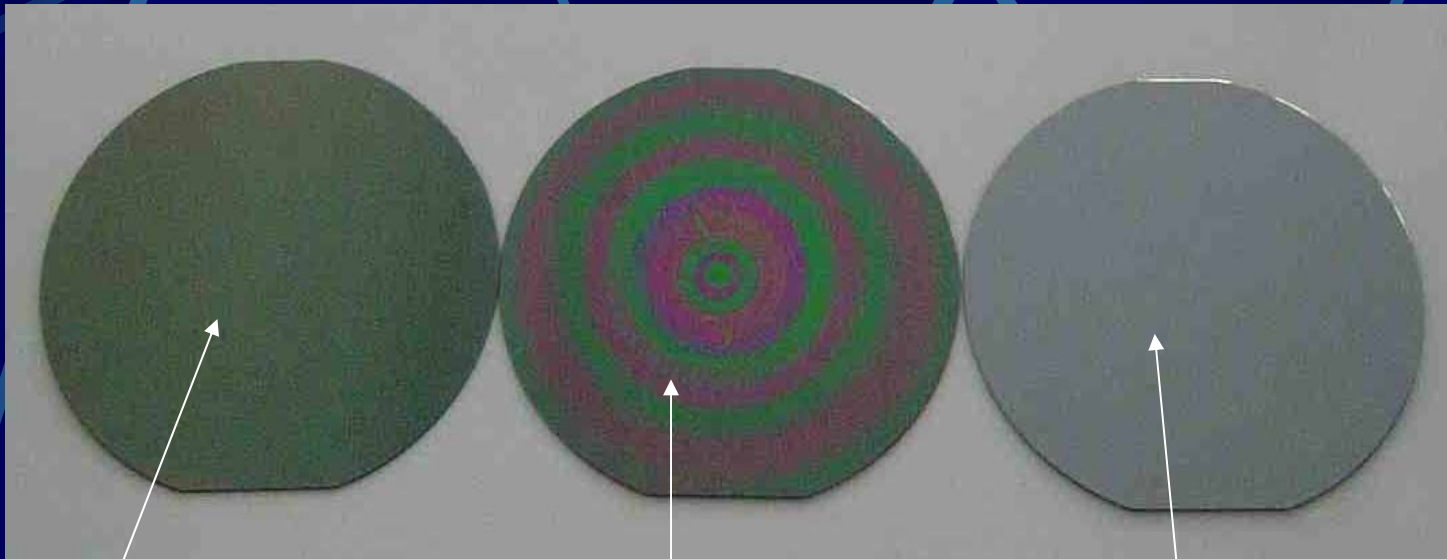
## Si wafer ADRE-plasma modification

Before treatment

After treatment



## Etching photo-resistant



Si wafer covered  
with photoresistant

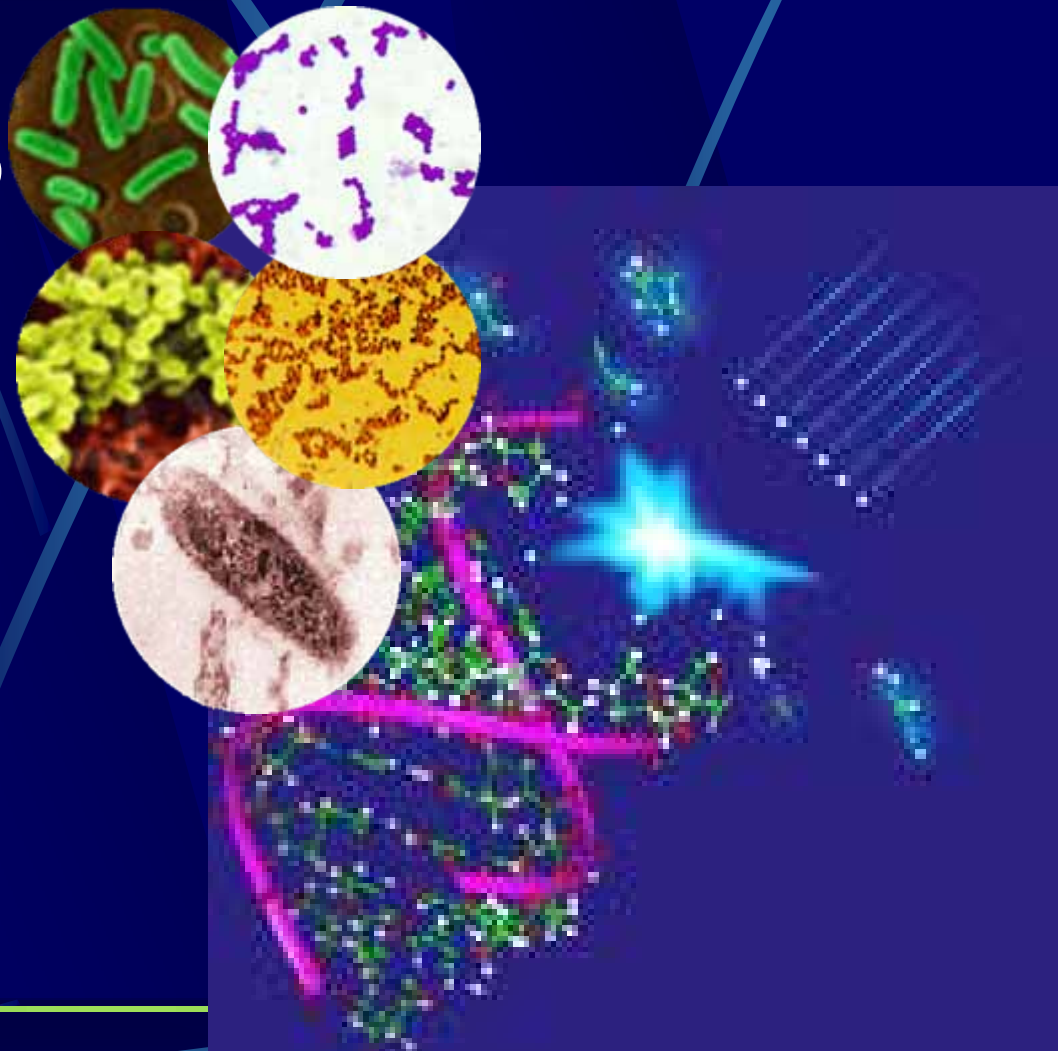
2 min etching

5 min etching

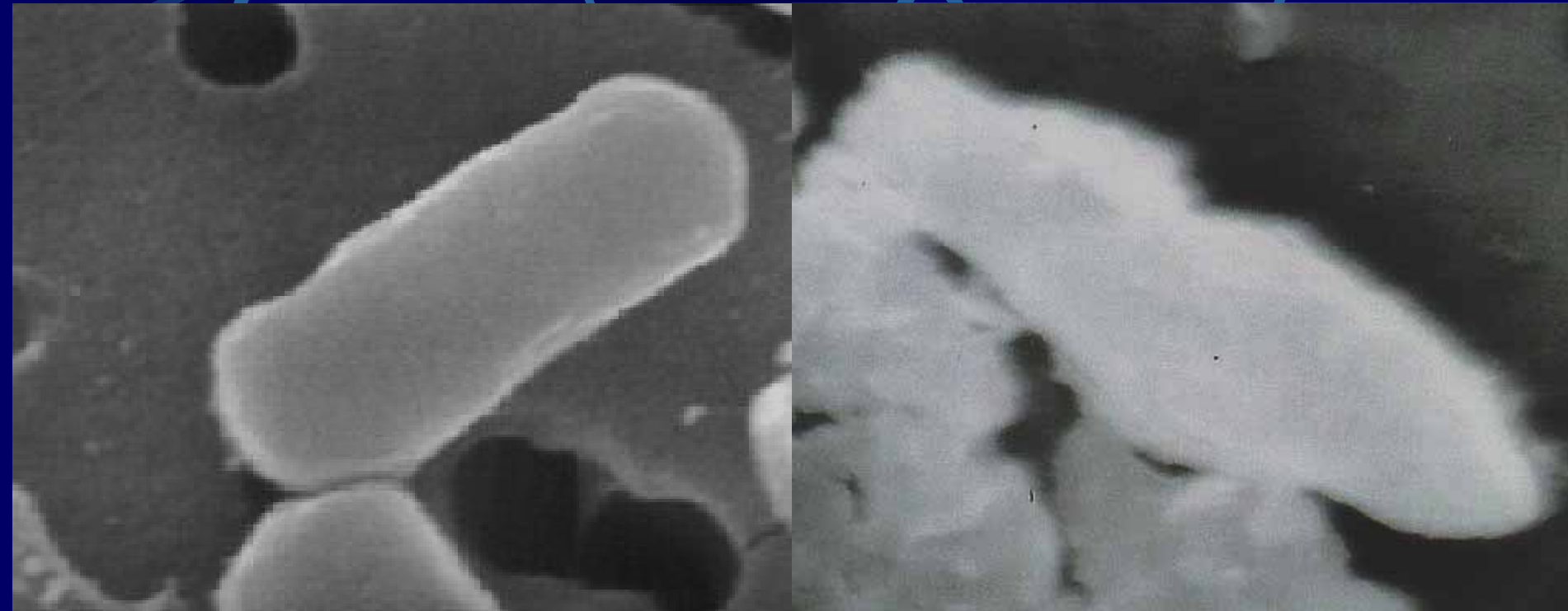


## Action Factors of ADRE

- Fast Electrons with average energy up to 300 keV and current amplitude up to 2 kA
- UV and X-Ray Radiation (258 nm, etc.)
- Electric Field with  $E \sim 100$  kV and nanosecond duration
- Chemically active molecules and radicals



## **ADRE-plasma sterilization**



Brood cell before treatment

Brood cell after treatment



# Electrodynamic Systems & Technologies

## *Sterilizing certification*



# Bacteriological Lab Building



## Sterility test

[illegible]

sterility	<i>blueaeruginosa</i>
sterility	<i>staphylococcus aureus</i>
sterility	<i>anthracoid</i>
sterility	<i>licheniformis</i>
sterility	<i>licheniformis</i>

Classe ou niveau d'enseignement	Nombre de professeurs pour les différentes disciplines	Classe ou niveau de formation des professeurs	Disciplines enseignées	Classe ou niveau de formation des professeurs
2e 474 (France)	anglais	anglais (UK)	Anglais (français)	de 101
3e 480 (France)	anglais	anglais (UK)	Anglais (français)	de 101
3e 481 (France)	anglais	anglais (UK)	Anglais (français)	de 101
3e 487 (France)	anglais	anglais (UK)	Anglais (français)	de 101
3e 503 (Canada)	anglais	anglais (UK)	Anglais (français)	de 101

Signature \_\_\_\_\_

Signature après approbation de la direction \_\_\_\_\_

Signature responsable \_\_\_\_\_ 1 474 (France)

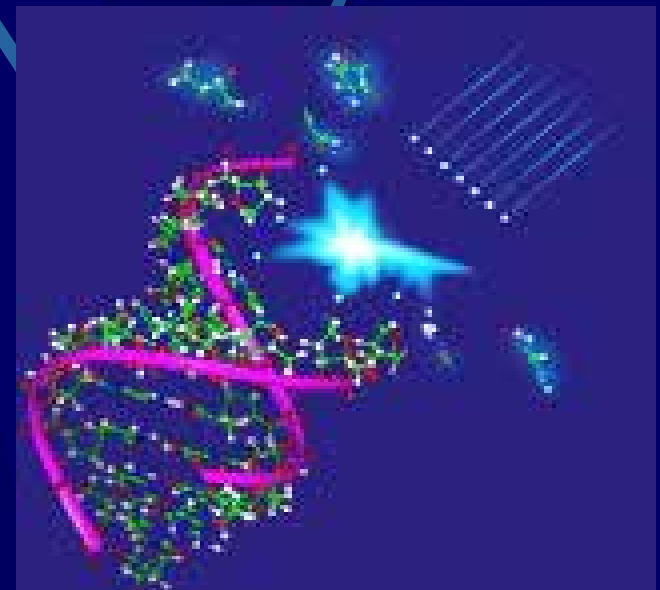
Signature de la DCE \_\_\_\_\_ 4 803 (France)

# Certificates



Electrodynamic Systems & Technologies

# ELECTRON STERILIZERS OF EST FAMILY



Conveyor type  
sterilizer ARTEMIS



# Electrodynamic Systems & Technologies

## Plasma pen prototype



It is hopefully to be used to treat skin illness on line



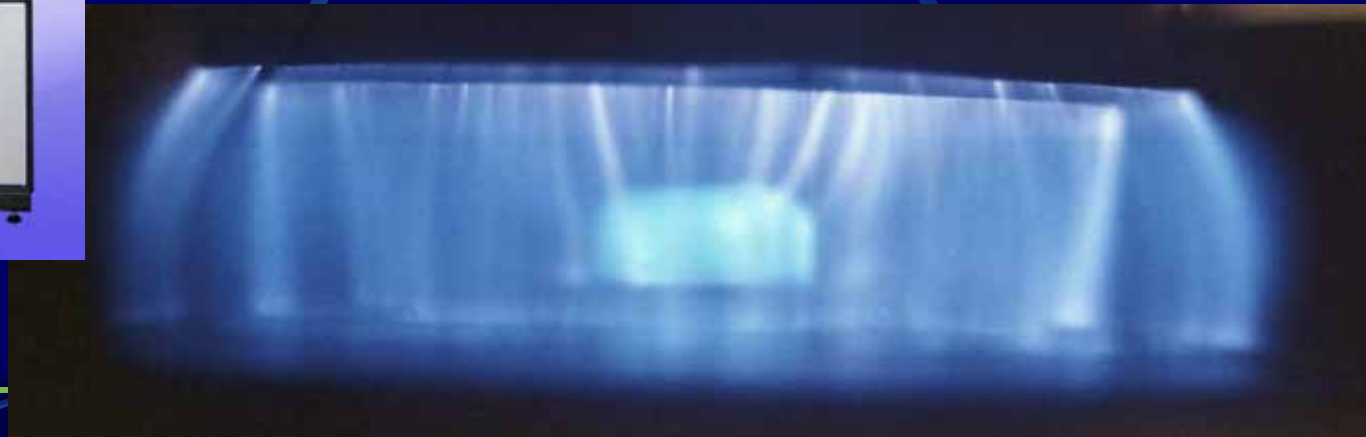
# Electrodynamic Systems & Technologies

## Water sterilization and treatment station **APHRODITE**

Capacity – 5 m<sup>3</sup>/h

Pool volume –  
30-100 m<sup>3</sup>

Power consumption  
– 2 kVA







# Electrodynamic Systems & Technologies

The first demonstration model of ADRE-sterilizer for packed surfaces



ELS – 150

$E = 100 \text{ keV},$

$I_m = 150 \text{ A},$

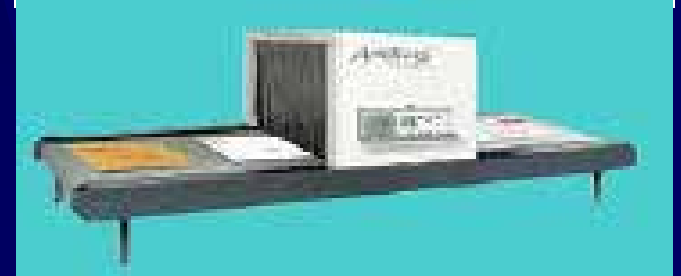
$f = 5 \text{ Hz}$



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# ADRE applications development directions

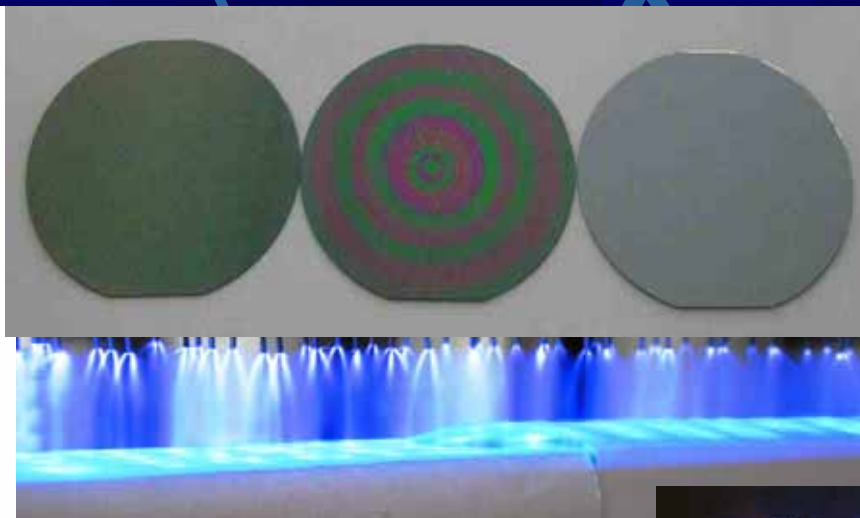
- Medical, household and special chamber express-sterilizers
- Conveyor – type express-sterilizer of surfaces and products
- Air, industrial gas, water and waste liquids purification systems





# Electrodynamic Systems & Technologies

## NOVELL COLD ATMOSPHERIC PLASMA TECHNOLOGIES & EQUIPMENT



**Cooperation proposal:**  
**Joint venture with about \$10 Mln.**  
**of investment during 1.5 years**  
**for \$ 100 Mln. income in 5 years**