

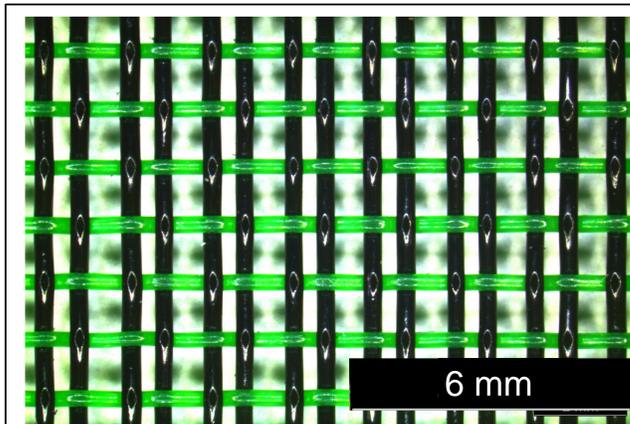
# Development of a Textile with Silica Coating for Environmental Friendly Control of Insects in Agricultural Production

## Aim of research

- Develop an agricultural net which
  - is eco friendly and non toxic and
  - can actively protect plants against all kinds of bugs by killing them by its sharp coating
- Ensure sustainable supply of food without chemical contamination

## Background

- Growing number of greenhouses (150,000 ha) and screenhouses (30.000 ha) in crop farming in the Mediterranean region
- Fine mesh sizes lead to a non-ideal growing environment (reduction of air ventilation and light transmission, increase or air temperature)



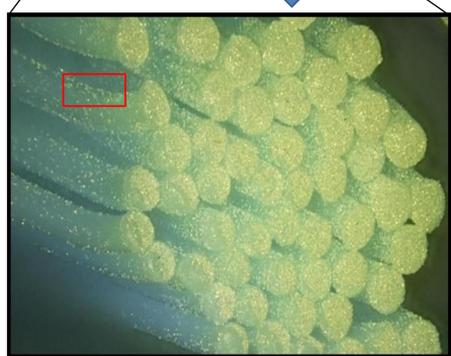
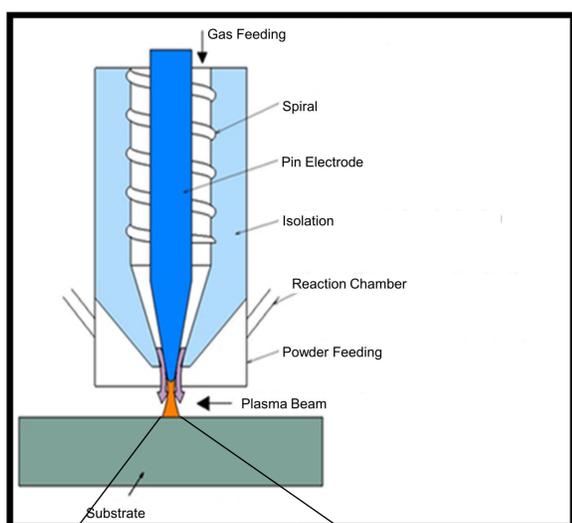
## Mesh characteristics

- Porosity
- Mesh size
- Thread dimension
- Texture (web, knitting)
- Resistance to airflow
- Light transmission/reflection
- Color

## Principle

- Thrips, whiteflies, aphids and leafminer are the most significant insects
- Filaments or textile fabrics in the vents of the greenhouse are homogeneously plasma-coated by sharp particles
- The particles harm the entering bugs by physically absorbing the protecting wax shell covering their chitin exoskeleton in a way the bugs die by drying out

## Plasma functionalization of the net surface



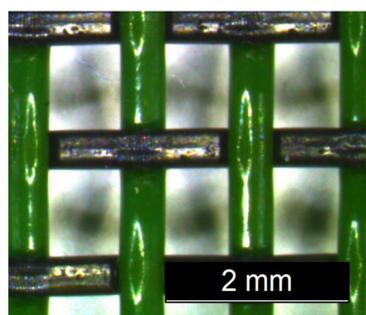
Diamant particles on fiber surface (application: polishing rag)

## Approach

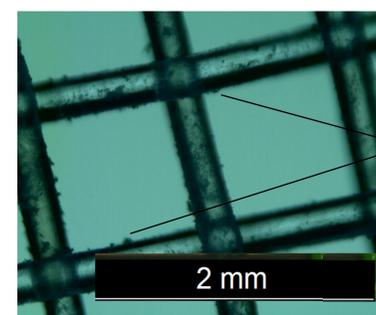
- Develop nets with bigger mesh sizes to overcome the disadvantages
- Plasma selection with regard to the polymer and the application
- Develop a plasma coating process for the selected silica particles to cover the fibers homogeneously
- To produce the fibers, a melt spinning process is developed with regard to particle processing, to the build-up of a coating and to the coated yarn and textile properties such as a low shrinkage to ensure further processability
- After prototyping textiles, the coating process is upscaled to textiles
- Finally, pilot greenhouse conditions are evaluated on the mesh to study the effect on the microclimate and on harmful insects in field trials

## Preliminary Results

- 32,84 % of open area in commonly used nets
- Defined coating material: Silica dioxide particles ( $\text{SiO}_2$ )
- Filtration tests for a melt spinning process of HD-PE:
  - monofilament die with L/D ratio of 4 (L = 4 mm, D = 1mm) leads to a pressure of 170 bar before the die; four-layer-filter with 80 $\mu\text{m}$  mesh size
- First net samples are plasma-coated with  $\text{SiO}_2$ -particles



Conventional



Reservoirs of sharp  $\text{SiO}_2$ -particles

Plasma-coated  
Monofilament Nets made from (HDPE)

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