



- PILOT

Navigates you through nanocomposites

# Open Access Colloidal Nanoparticles Pilot Lines

**Victor Trapp & Aike Wypkema**  
**(Fraunhofer ISC, DE) (TNO, NL)**

ESOF satellite event on Communication, Dissemination and Exploitation  
Toulouse 9 July 2018



THE NANOPARTICLE KITCHEN

# COPILLOT Overview



- TNO/ Fraunhofer ISC
- Open Pilot Facilities: South Netherlands (NL); Bavaria (D)
- Instrument makers (CH; D; F)
- Occupational Health & Safety / Business Planning



**TNO** innovation  
for life



**LS** instruments



**Fraunhofer**  
ISC

**nano**House

**MOMENTIVE**

**Nabaltec**

**SKZ**

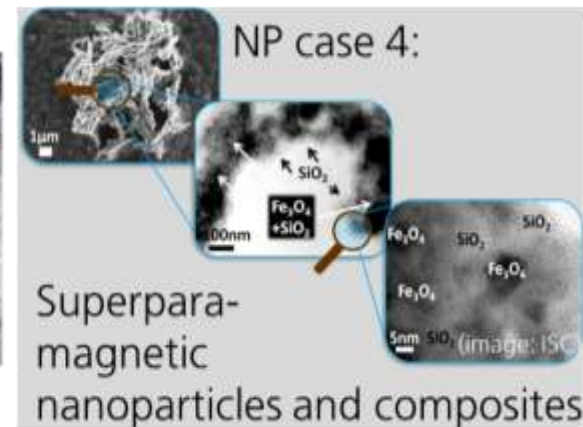
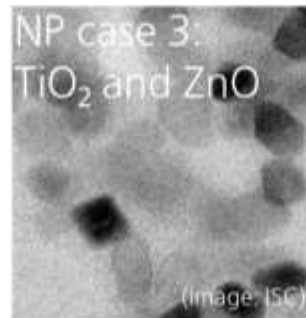
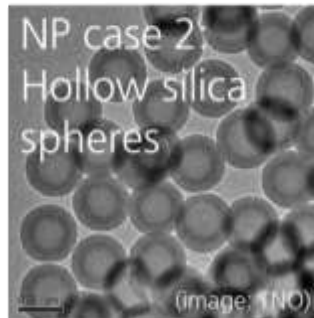
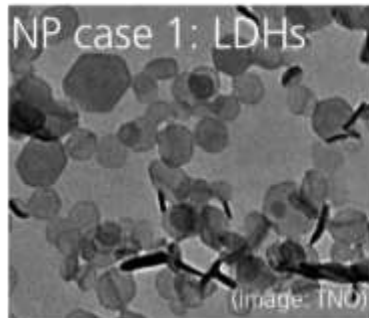
**KRIYA**  
MATERIALS



**- PILOT**  
Navigates you through nanocomposites

# COPILOT Overview

- 4 NP cases mainly driven by SME partners and market need
- Pilot lines in two sizes, at two locations
- Several key applications & several equipment developments



[www.h2020copilot.eu](http://www.h2020copilot.eu)

# COPILLOT infrastructure in DE & NL

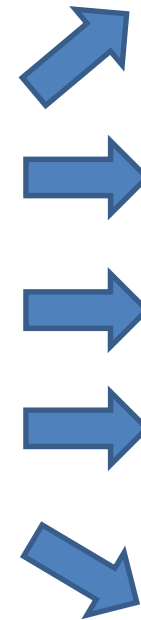
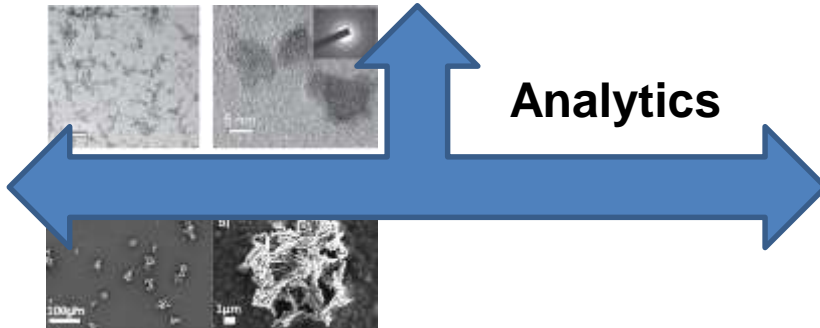
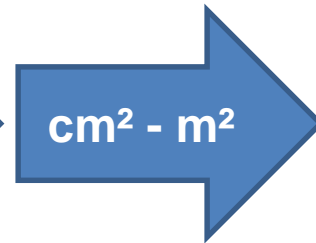
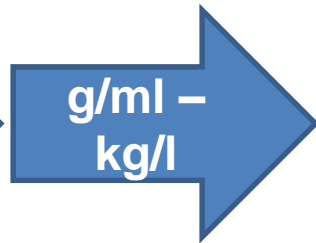
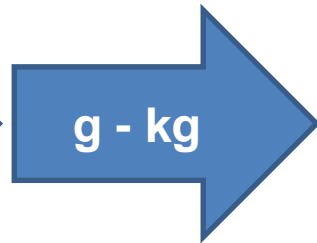
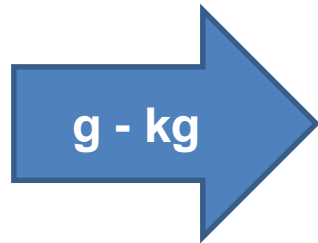


**NP  
synthesis**

**NP  
modification**

**NP  
dispersion**

**NP  
coatings**



**Many different applications/ products**  
**CHALLENGE: support SME in starting!!!**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 645993.

# Bridge the TRL gap



- PILOT  
Navigates you through nanocomposites



## Technology Readiness Levels

- TRL 0: Idea.** Unproven concept, no testing has been performed.
- TRL 1: Basic research.** Principles postulated and observed but no experimental proof available.
- TRL 2: Technology formulation.** Concept and application have been formulated.
- TRL 3: Applied research.** First laboratory tests completed; proof of concept.
- TRL 4: Small scale prototype** built in a laboratory environment ("ugly" prototype).
- TRL 5: Large scale prototype** tested in intended environment.
- TRL 6: Prototype system** tested in intended environment close to expected performance.
- TRL 7: Demonstration system** operating in operational environment at pre-commercial scale.
- TRL 8: First of a kind commercial system.** Manufacturing issues solved.
- TRL 9: Full commercial application,** technology available for consumers.



# Key applications

## Sustainable Buildings



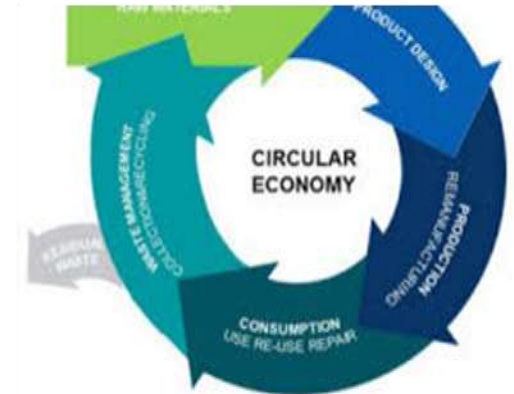
- Attracted 5 million euro from investors in 2015-2017
- Estimates 2-3 million euro annual turnover after 3 years for the developed coatings and foils.

## Safety



- Attracted 0,5 million euro from investors in 2015-2017
- Demonstration of 1.000 liter PET and PA chemical recycling plant
- Expect a 10.000 ton p.a. plant in 2021

## Chemical Recycling



# Equipment SME improved their products (examples)

High precision colloidal nanoparticle production inline monitoring system



- 3 million euro annual instrument sales expected after 3 years;
- 10-20 times higher sales if a potential application in the pharmaceutical application area becomes successful;

- Presented at the Achema 2018 for commercial sale
- after 3 years an additional annual sales of 0.8 Mio€ is estimated for the new developed machines



High through-put downstream processing



# Continuation model

  
**Technology Readiness Levels**

- TRL 0: Idea.** Unproven concept, no testing has been performed.
- TRL 1: Basic research.** Principles postulated and observed but no experimental proof available.
- TRL 2: Technology formulation.** Concept and application have been formulated.
- TRL 3: Applied research.** First laboratory tests completed; proof of concept.
- TRL 4: Small scale prototype** built in a laboratory environment ("ugly" prototype).
- TRL 5: Large scale prototype** tested in intended environment.
- TRL 6: Prototype system** tested in intended environment close to expected performance.
- TRL 7: Demonstration system** operating in operational environment at pre-commercial scale.
- TRL 8: First of a kind commercial system.** Manufacturing issues solved.
- TRL 9: Full commercial application,** technology available for consumers.



Brightlands  
Materials Center



THE NANOPARTICLE KITCHEN



Co-Pilot  
consortium  
companies

Other  
companies

Spin-out  
companies



**H2020 Open  
Innovation Test Bed  
(in preparation)**



End-users / consumers






## High level of dissemination actions (during/ after project)

- Booth exhibitions, presentations, newsletters, website
- workshops given by COPILOT partners
- Small trial projects with other companies
- Developing and marketing propositions
- Plugging into the European ecosystem (EPPN etc.)

Year	Total events	Total talks	Total pitches	Total booth demo's	Partners involved
2015	5	10	-	-	TNO, ISC, SKZ, Kriya, MPM, Nanohouse
2016	10	13	-	1	TNO, ISC, LS, SON, CEPA, Kriya, Nab, MPM, ION, Nanohouse
2017	14	14	2	2	TNO, ISC, SKZ, LS, SON, CEPA, Kriya, Nab, MPM, ION, Nanohouse, TCD
2018	5	5		2	TNO, ISC, SKZ, CEPA, Kriya




**THE NANOPARTICLE KITCHEN**

© source: Reckl - Fotolia

Have you ever thought of how your nanoparticles could be upscaled or how nanoparticles could be added to increase your product performance? With our extensive pilot line equipment we can support you in synthesis, modification as well as dispersion of nanoparticles in different upscaling stages.

Our laboratory works like a kitchen – you come to us with a specific menu or taste in mind. We provide the cooking ingredients, the pans and stove, as well as the internationally experienced cooks. You are welcome as well, if you want

**SPECIAL EQUIPMENT...**



© Invello.de

Message to the market:  
**We do *not* “sell” nanoparticles, we sell hands-on consulting for material solutions**

<https://www.isc.fraunhofer.de/en/fields-of-activity/materials/particles.html>

- Spray-drying facilities
- Continuous flow globe mill
- Molecular vaporizer
- Magnetic drum separator
- Encapsulation device
- Ultrafiltration
- Glas autodave
- Fluidised bed reactor
- ... and many more

**Our Special Ingredients**

We offer materials development and custom manufacturing of small particles matching your demands, for instance:

- Magnetic Particles
- Hollow Particles
- Silica Particles
- Layered Particles
- Titanium, Zirconium, Zinc and Perovskite Oxide Particles

**Interested in the nanoparticle kitchen taste? Contact us!**

Fraunhofer Institute for Silicate Research ISC | Neuer Platz 2 | 97082 Würzburg | Germany  
Dr. Karl-Sebastian Mandel | Phone +49 931 4100-402 | nanoparticlekitchen@isc.fraunhofer.de  
[www.isc.fraunhofer.de](http://www.isc.fraunhofer.de)



**...WITH SPECIAL INGREDIENTS**



© Jan Wäntjes | Invello.de

Additional “Walk the talk” by video

<https://www.youtube.com/watch?v=5m1jEOjWRZw>

# Contact information



Pascal Buskens  
[Pascal.buskens@  
tno.nl](mailto:Pascal.buskens@tno.nl)



Johan Tiesnitsch  
[Johan.tiesnitsch@  
brighlandsmc.com](mailto:Johan.tiesnitsch@brighlandsmc.com)

THE NANOPARTICLE KITCHEN



Karl-Sebastian Mandel  
[Karl.mandel@  
isc.fraunhofer.de](mailto:Karl.mandel@isc.fraunhofer.de)



Victor Trapp  
[Victor.trapp@  
isc.fraunhofer.de](mailto:Victor.trapp@isc.fraunhofer.de)

**Thank you for your attention  
as well as  
past and future support!**