



# Horizon2020 Information Days on Public-Private Partnerships

Brokerage event  
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## ***Intensification of Solids Processing Using Electromagnetic Technologies (ISPET)***

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# National Centre for Industrial Microwave Processing (NCIMP)

University of Nottingham, UK

## Who we are

- **Multi-disciplinary research group** at University of Nottingham – T/O £560m p.a.
- **Industry focused; 15 years' of experience**
- Research Excellence: **45 researchers**; 65% of papers in A\* Journals
- **Unmatched metrology and experimental facilities**: from lab to pilot scale capable of delivering over 800kW microwave power at 896MHz

## What we do

- Focused on developing a **fundamental understanding** of the interaction between electromagnetic energy and materials
- Design and **scale-up** of industry processes
- Work across full TRL spectrum
- **Process Intensification**: Fine/Bulk Chemicals, Food, Pharma, Fuels (Bioenergy, Oil & Gas), Minerals, Metals, Ceramics & Polymers

## Expertise

- **Scaled and licensed 4 industrial microwave technologies** including the world's largest capable of treating 150 tonnes solids per hour
- **Strategic partnerships** with e2v technologies (a world-leader in the design and manufacture of microwave hardware) and end user Rio Tinto

**Conventional Heating** - Heat is transferred from the outside by conduction, convection or radiation

# ISPET Concept

**Call - SPIRE 8** Solids handling for intensified process technology

**Call Need:** To adopt miniaturised, sustainable, highly intensive processes for solid materials

**Current situation: Conventional heating methods - Issues**

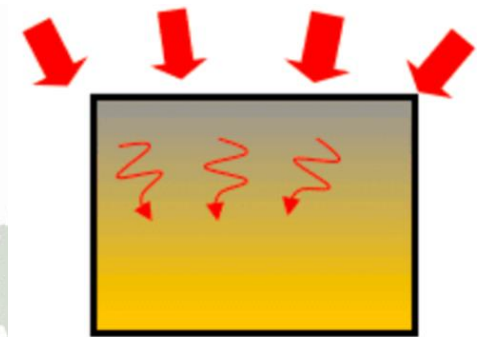
- Constrained by conventional heat and mass transfer limitations
- Large reactors, equipment and plant footprint
- Slow processes exhibiting poor energy efficiency
- Temperature gradients degrading product quality

**Desired situation:** Miniaturised and intensive processes and equipment delivered by innovations in solids handling - **Issues**

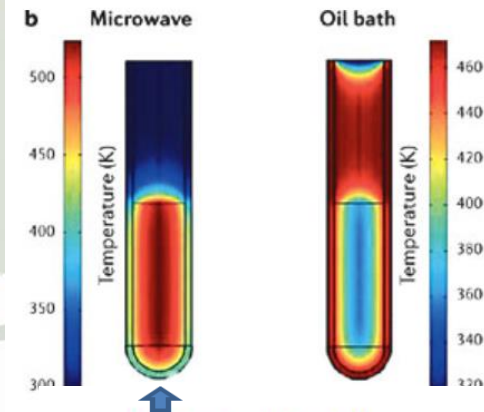
- You still suffer from conventional heat and mass transfer limitations

**ISPET's solution:**

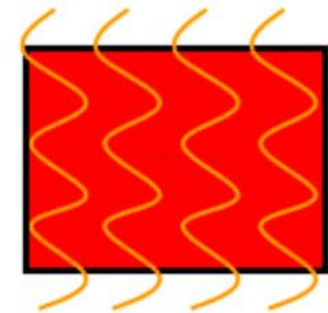
- Microwave heating technology - **Industrial Microwave Processing**
- A completely new approach
- Exploiting **volumetric** and **selective** heating enables:
  - Smaller equipment with reduced cost and improved sustainability
  - Continuous, faster and more flexible processing
  - Improved energy and raw material efficiency
  - Superior product quality and throughput



Heat slowly transfers to the centre by conduction



**Microwave heating**

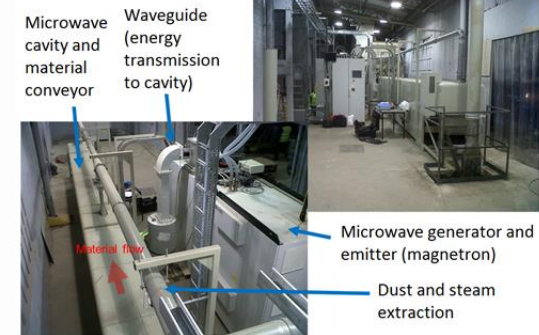


Heat is generated instantly and everywhere within the material

# ISPET Project



Continuous microwave heating concept demonstrated at TRL7



Continuous microwave process technology – an industry-scale system demonstrated at TRL7

## Aim:

- To demonstrate miniaturised, intensive microwave processing equipment for High Temperature HT ( $\gg 150^{\circ}\text{C}$ ) processing of solids;

## Objectives:

- new solids handling technologies (cleaning, fouling, agglomeration)
- new process design methodologies for high temperature microwave processing, allowing other cross-sectorial applications to progress to a commercial scale
- scale up & integration of miniaturised, highly intensive microwave processing equipment at TRL7
- optimisation, test and validation - full process engineering
- techno-economic assessment / lifecycle analysis
- intelligent process control and monitoring systems

**Specifics:** 4 year, €12m market-orientated project (innovation action)

# MAIN EXPECTED IMPACT

In relation to the call topic addressed

- **Commercially available intensified equipment**
- novel, intensified and cost effective equipment at TRL7, representing a cross-sector platform technology
- Key aspects:
  - Fast and flexible
  - Major reductions in energy use (up to 90%)
  - Major reductions in equipment size and facility footprint (up to 90%)
  - Superior products and product yield at a highly controllable specification
- Other benefits include:

Increased throughput, improved resource efficiency, process simplification, improved safety and working conditions for operators, reduced bulk reaction temperature, reduced requirements for cooling and storage, reduced maintenance costs and significantly reduced start-up and shut-down times

# EXPECTED IMPACT

## Cross-sectorial characteristics

- **Reductions of up to 90% in energy intensity** for a range of energy intensive industry processes (**SPIRE roadmap**)

### Cross-sectorial characteristics of the idea:

- ISPET requires cross-sector collaboration and will strive for **Cross-sectorial technology transfer and exploitation**
  - Delivery of **knowledge-based equipment and platform technology** applicable to:
    - many thermally-driven processes
    - many SPIRE industry sectors (e.g. chemicals, polymers, biofuels, foods, minerals, ceramics, cements, metals, recycling and energy recovery)
  - Technology and **generic process design methodologies** to allow other concepts and applications to progress to commercial scale across a host of applications, markets and sectors

# EXISTING PROJECT CONSORTIUM

The following partners have indicated their interest in the project idea:

- *Microwave hardware and scale-up methodologies*
  - e2v technologies, UK - Microwave equipment manufacturer
  - University of Nottingham, UK – Science and Scale-up
  - Britest, UK - Innovative process design solutions
  - Fraunhofer IPA , Germany - Resource/energy efficient production
  - Eindhoven University of Technology, Holland – Control systems
- *High temperature processing and solids handling*
  - Tel-Tek, Norway - Materials handling
  - Tudor, Luxembourg - High temperature materials processing

The logo for e2v technologies, featuring the lowercase letters 'e2v' in a bold, dark blue, sans-serif font.

The University of  
Nottingham

UNITED KINGDOM • CHINA • MALAYSIA

The logo for Tudor, featuring the word 'tudor' in a bold, blue, lowercase sans-serif font, with 'PUBLIC RESEARCH CENTRE HENRI TUDOR' in a smaller blue font below it.

Fraunhofer  
IPA

The logo for TU/e, featuring the letters 'TU/e' in a bold, blue, sans-serif font, with 'Technische Universiteit Eindhoven University of Technology' in a smaller blue font to the right, and the tagline 'Where innovation starts' in a smaller blue font below it.

# LOOKING FOR PARTNERS

- *Process equipment manufacturers* with an interest to develop innovative and intensive process technology, who could benefit from the cross-sectorial applications and market opportunities this project will unlock
- *Problem holders (end users)* - industry end users from all Spire sectors focused on innovation and on implementing responsible and value-creating solutions
- *Solids handling technology providers (Companies / SMEs)* with an interest to embed their technology in new industrial systems and processes
- *Technology providers for cleaning, fouling and agglomeration*

# BENEFITS TO INDUSTRY PARTNERS

- **New step-change platform technology and methodologies to access global markets worth billions of Euros per annum**
- **New equipment, processes and services facilitated by 10m Euro of EU funding**
- **Rapid commercialisation of R&D results**
- **Preferential access to project results**
- **Preferential rights in the supply chain**
- **An opportunity to control and own Intellectual Property**
- **An EU grant of 70%** of the money you spend for large industry partners: 100% for SMEs

# CONTACT DETAILS

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[NCIMP - National Centre for Industrial Microwave Processing](http://www.nottingham.ac.uk/research/groups/industrial-microwave-processing/index.aspx)  
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