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Advanced Applications for Inorganic Nanomaterials

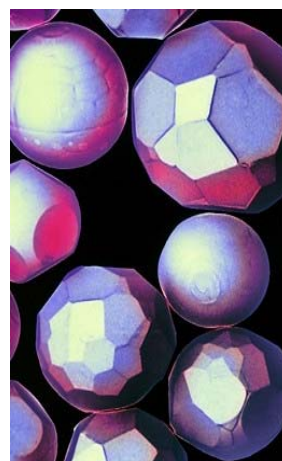
Dr. Paul Reip

Director – Government and Strategic Programmes



Intrinsiq Materials Ltd

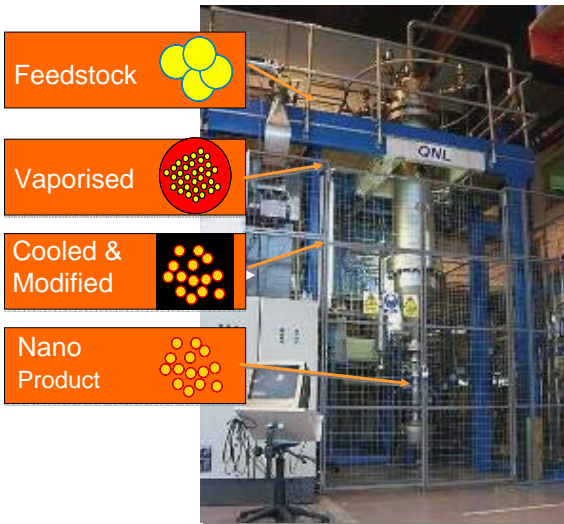
- Leading Nanotechnology Company with a broad set of international customers and partners.
- Powerful Platform Technologies
 - Novel tool for development and manufacture of novel nanomaterials
 - Controlled release of high value actives
 - **Novel antimicrobial and antiviral materials**
 - **Printed Electronic solutions**
- Considered by HSE/HSL as leaders in safe inorganic nanomaterial production, handling, packing and shipping.
- Substantial IP portfolio of 34 patent families







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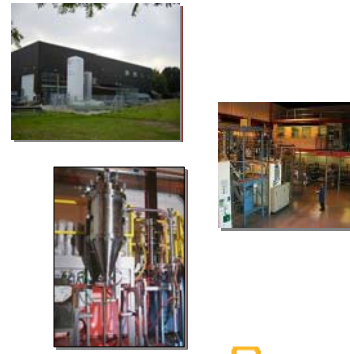


IML's Patented Development Tool & Production Process



- Feedstock 
- Vaporised 
- Cooled & Modified 
- Nano Product 





IML is one of the few companies that has both a powerful development tool *and* scalable production process



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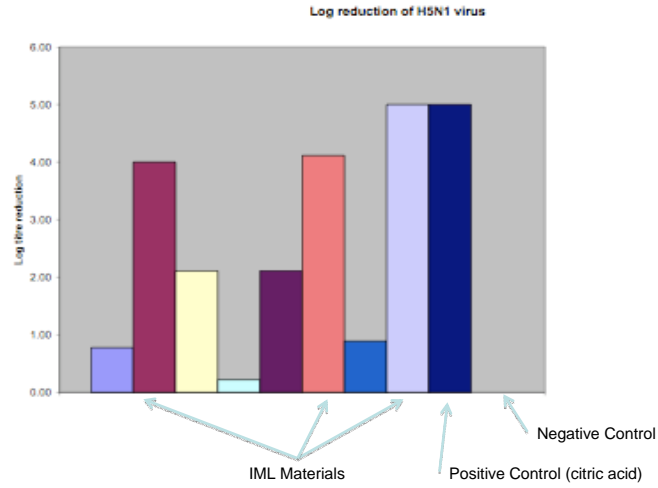
IML nanomaterials

 <p>Metals</p> <p>Aluminium, <u>Copper</u> Silver, Nickel Cobalt, Titanium Stainless Steel Tungsten, Silicon Tantalum Molybdenum</p>	 <p>Oxides</p> <p>Zinc Oxide, Copper Oxide Cerium Oxide, Tin Oxide Cuprous Oxide, Titanium Dioxide Nickel Oxide, Zirconium Oxide</p>	 <p>Carbides and Nitrides</p> <p>Tungsten Carbide Aluminium Nitride Aluminium Oxy Nitride Silicon Nitride Boron Nitride</p>	 <p>Mixed Materials</p> <p>Blends Alloys Doped Structured Stoichiometry</p>
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Antiviral Actives vs Influenza Virus – H5N1 (bird flu)

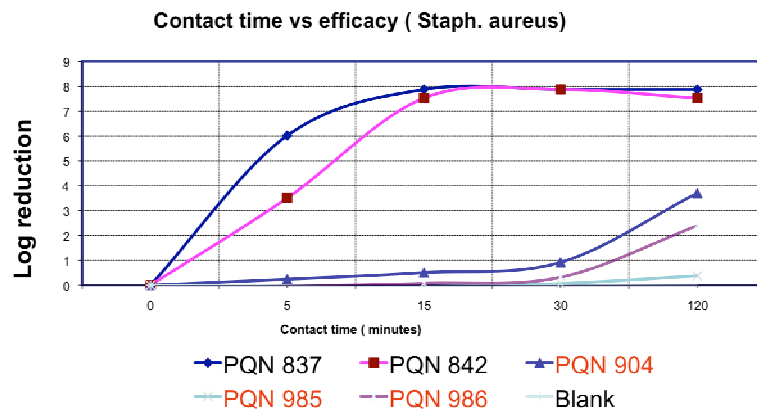


Actives Screening vs Controls

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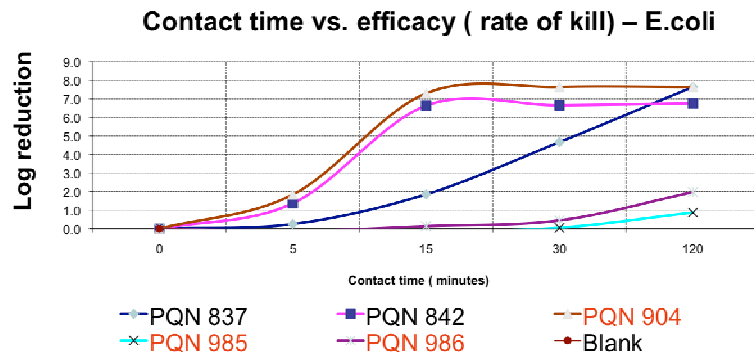
Antibacterial efficacy – Staph. aureus



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Antibacterial efficacy – E.coli

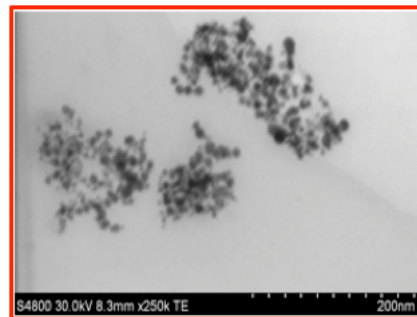
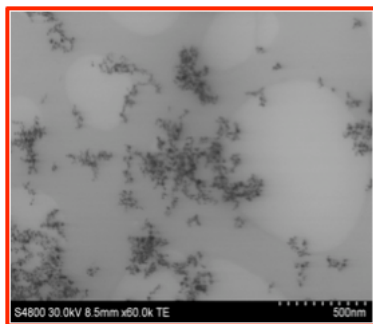


PQN 842; effective for both organism (6-6.5 log reduction in 15 minutes)

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Dispersion (in house technique, water base)



Extremely small particle distribution – easy to disperse

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Application Flexibility



Uncoated



Nano coated

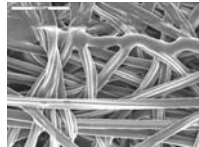


Coated paper

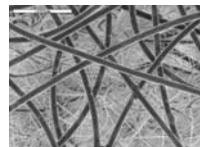


Nano-latex glove

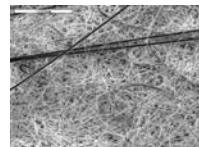
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Melt blown
nonwoven



Spun bond
polyester



HEPA glass
fiber

Filter media coated with active material



Intrinsiq Materials' Solution

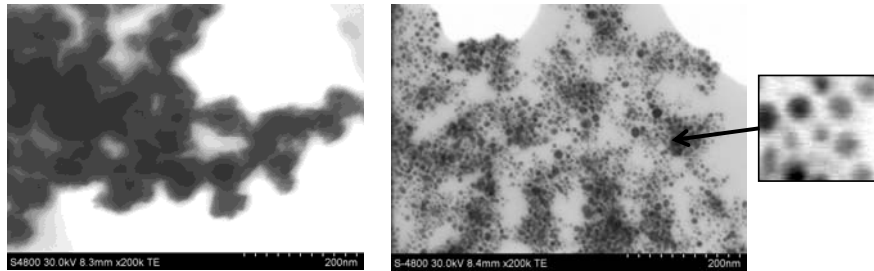
- **Broad Spectrum Biocide**
 - antibacterial / antiviral / antifungal
- **Performance**
 - Inorganic material and not organic material
 - Durable
 - Effective
- **Processing Flexibility**
 - Technology to incorporate nanoparticles into fibers / coatings etc
- **Safety**
 - Components are well known and generally considered as safe

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Modification of Nanoparticles

- Reactive gases in the reactor can be used to minimize or remove unwanted contaminants
- Particles can be coated to prevent agglomeration and surface oxidation
- Coating can be designed to degrade on sintering



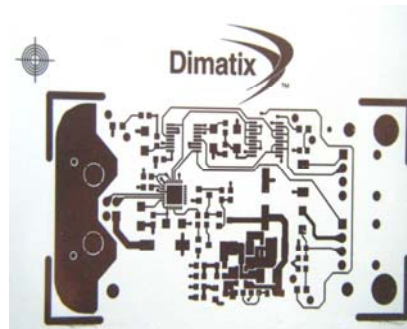
STEM images showing the effect of coating on particle morphology
(10nm initial particle size)

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Ink Formulation

- Viscosity / surface tension can be varied to meet application demands
- Compatible with Standard industrial low cost Inkjet print heads (XAAR & Dimatix)
- Circuits ready for population
- Conductivity suitable for carrying digital signals
- Printing on low temperature substrates



Substrate Compatibility (Tests to date):

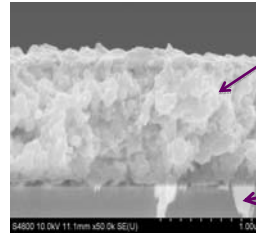
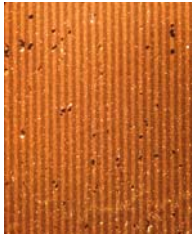
- Alumina
- Polyimide
- Glass
- Paper

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The way forward ...

Laser Sintering



Sintered
Copper
layer

Glass
slide

Optical micrographs of laser sintered tracks at 100 and 250 micron line spacing on paper

Market Development

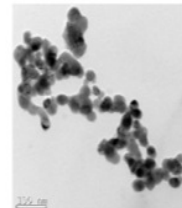
- Specialist 3D antenna application
- Multilayer structures including printing of dielectric
- RFID on paper

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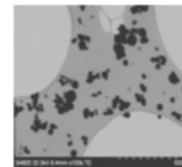


Intrinsiq Materials' Solution

- **Production capability:** Patented, scalable process and expertise to deliver commercial volume production
- **Formulated inks:** Intrinsiq scientists have substantial experience and previous success in producing printable inks for the RFID industry
- Intrinsiq Materials has now **successfully developed a product** that is undergoing commercialisation
- **Routes to market** are being developed
- Now in discussions to take the product forward **in collaboration with industry**



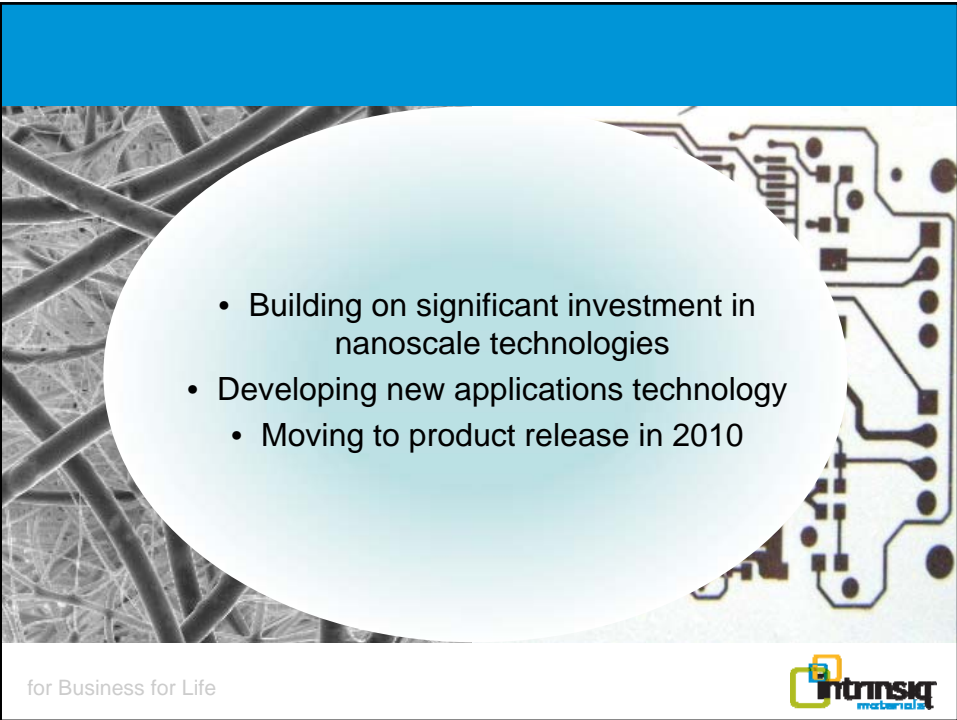
Existing SoA technology



IML Coated Copper
Technology @ 15nm

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- 
- Building on significant investment in nanoscale technologies
 - Developing new applications technology
 - Moving to product release in 2010

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Thank you

Business Development Enquiries:
Dr. Ian Clark - Sales & Marketing Director
(ianclark@intrinsicmaterials.com)

