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Advanced Applications for Inorganic Nanomaterials

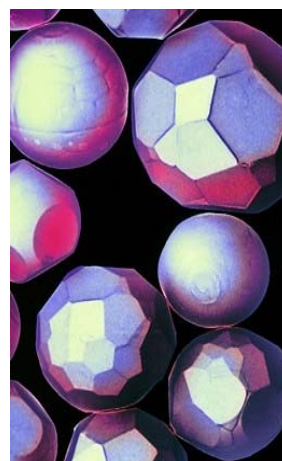
Dr. Paul Reip

Director – Government and Strategic Programmes



Intrinsiq Materials Ltd

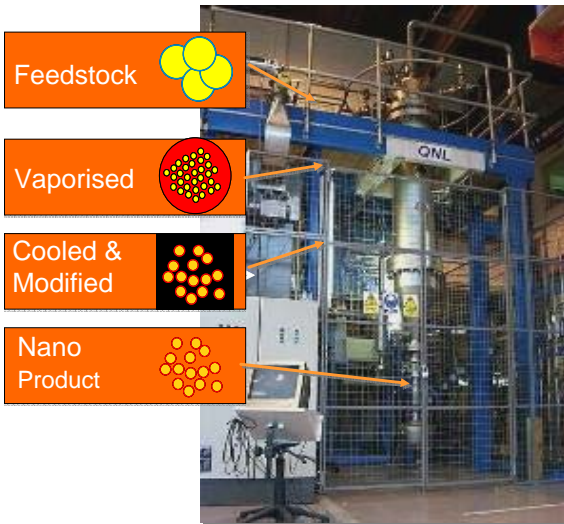
- Leading Nanotechnology Company with a broad set of international customers and partners.
- Powerful Platform Technologies
 - Novel tool for development and manufacture of novel nanomaterials
 - Controlled release of high value actives
 - **Novel antimicrobial and antiviral materials**
 - **Printed 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




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



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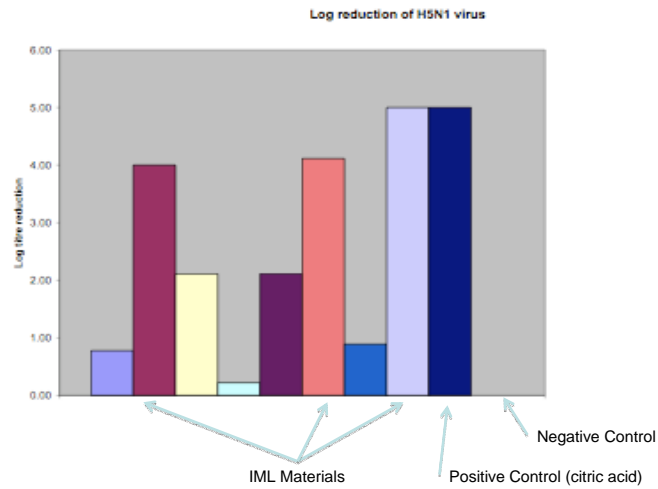
IML nanomaterials

Metals	Oxides	Carbides and Nitrides	Mixed Materials
 Aluminium, <u>Copper</u> Silver, Nickel Cobalt, Titanium Stainless Steel Tungsten, Silicon Tantalum Molybdenum	 Zinc Oxide, Copper Oxide Cerium Oxide, Tin Oxide Cuprous Oxide, Titanium Dioxide Nickel Oxide, Zirconium Oxide	 Tungsten Carbide Aluminium Nitride Aluminium Oxy Nitride Silicon Nitride Boron Nitride	 Blends Alloys Doped Structured Stoichiometry

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Antiviral Actives vs Influenza Virus – H5N1 (bird flu)

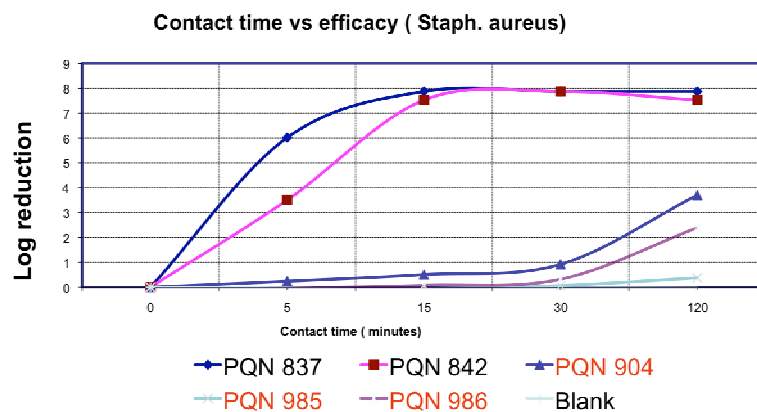


Actives Screening vs Controls

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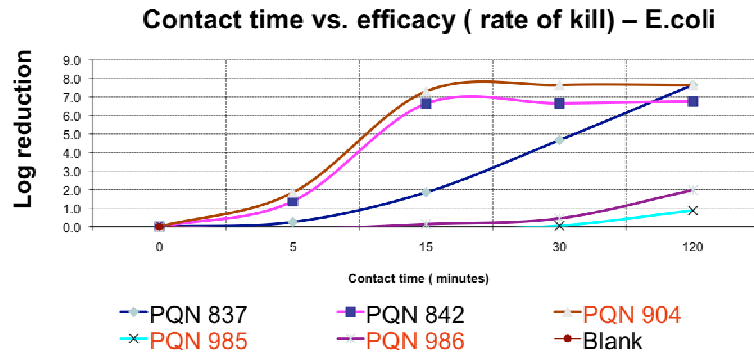
Antibacterial efficacy – Staph. aureus



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Antibacterial efficacy – E.coli

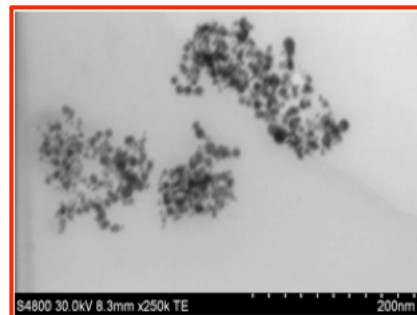
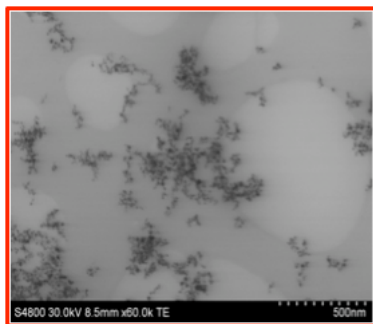


PQN 842; effective for both organism (6-6.5 log reduction in 15 minutes)

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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

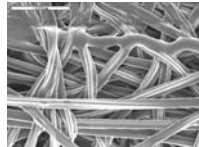


Coated paper

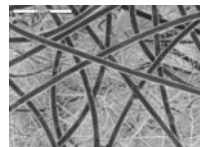


Nano-latex glove

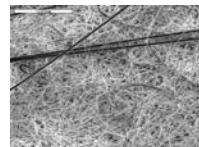
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Melt blown
nonwoven



Spun bond
polyester



HEPA glass
fiber

Filter media coated with active material



Intrinsiq Materials' Solution

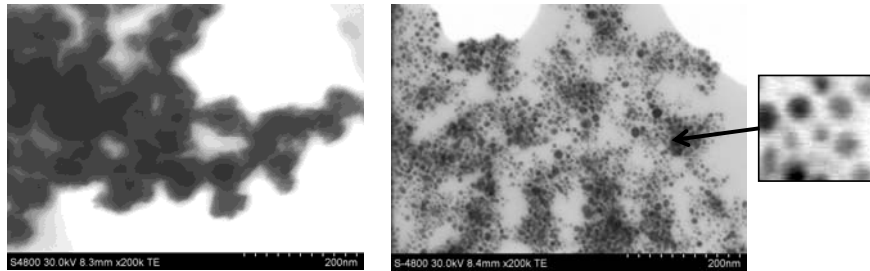
- **Broad Spectrum Biocide**
 - antibacterial / antiviral / antifungal
- **Performance**
 - Inorganic material and not organic material
 - Durable
 - Effective
- **Processing Flexibility**
 - Technology to incorporate nanoparticles into fibers / coatings etc
- **Safety**
 - Components are well known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



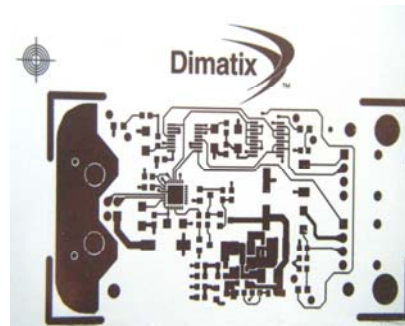
STEM images showing the effect of coating on particle morphology
(10nm initial particle size)

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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



Less than 0.02 g used (100 mm x 100 m tile)

Substrate Compatibility (Tests to date):

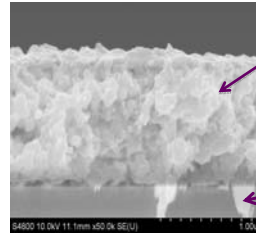
- Alumina
- Polyimide
- Glass
- Paper

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The way forward ...

Laser Sintering



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

Market Development

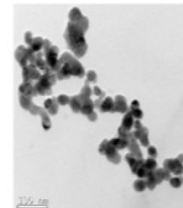
- Specialist 3D antenna application
- Multilayer structures including printing of dielectric
- RFID on paper

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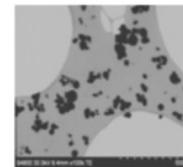


Intrinsiq Materials' Solution

- **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

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