

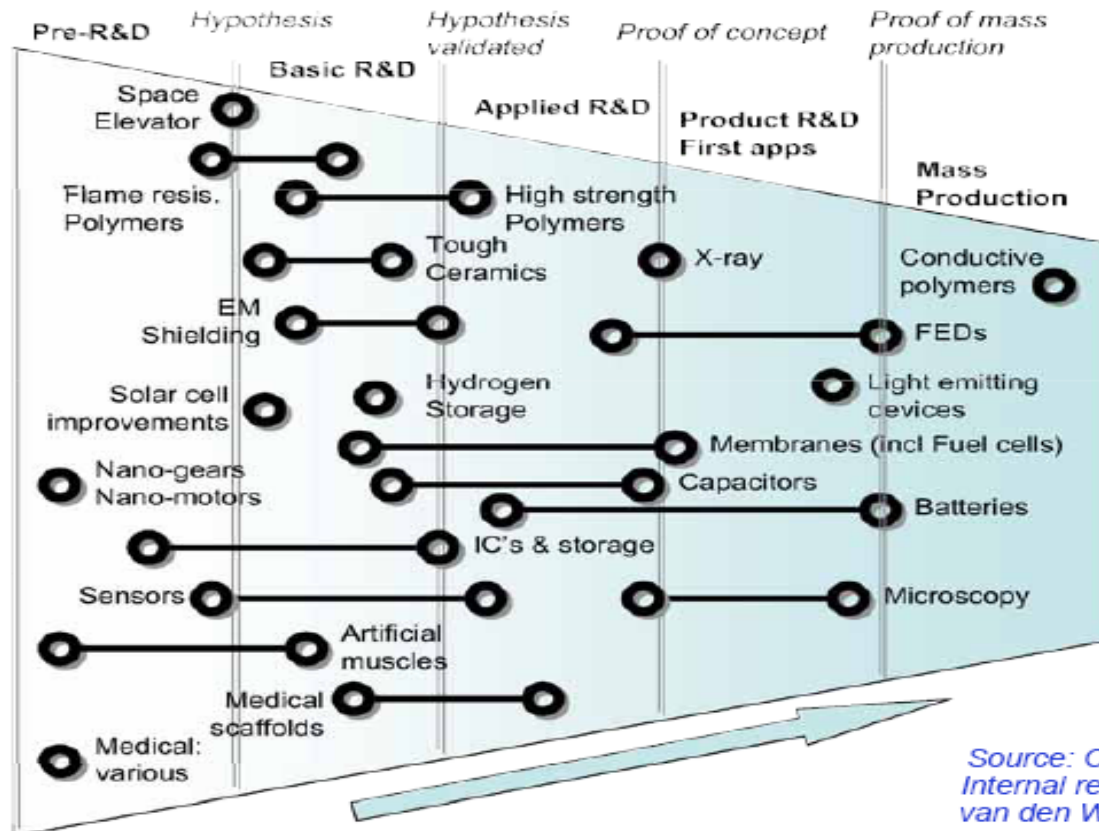
Who is Making Money from Nanomaterials and How? - The Value Chain and Business models for Nanomaterials

Technology For Industry Ltd
Cambridgeshire, UK
www.tfi-ltd.co.uk

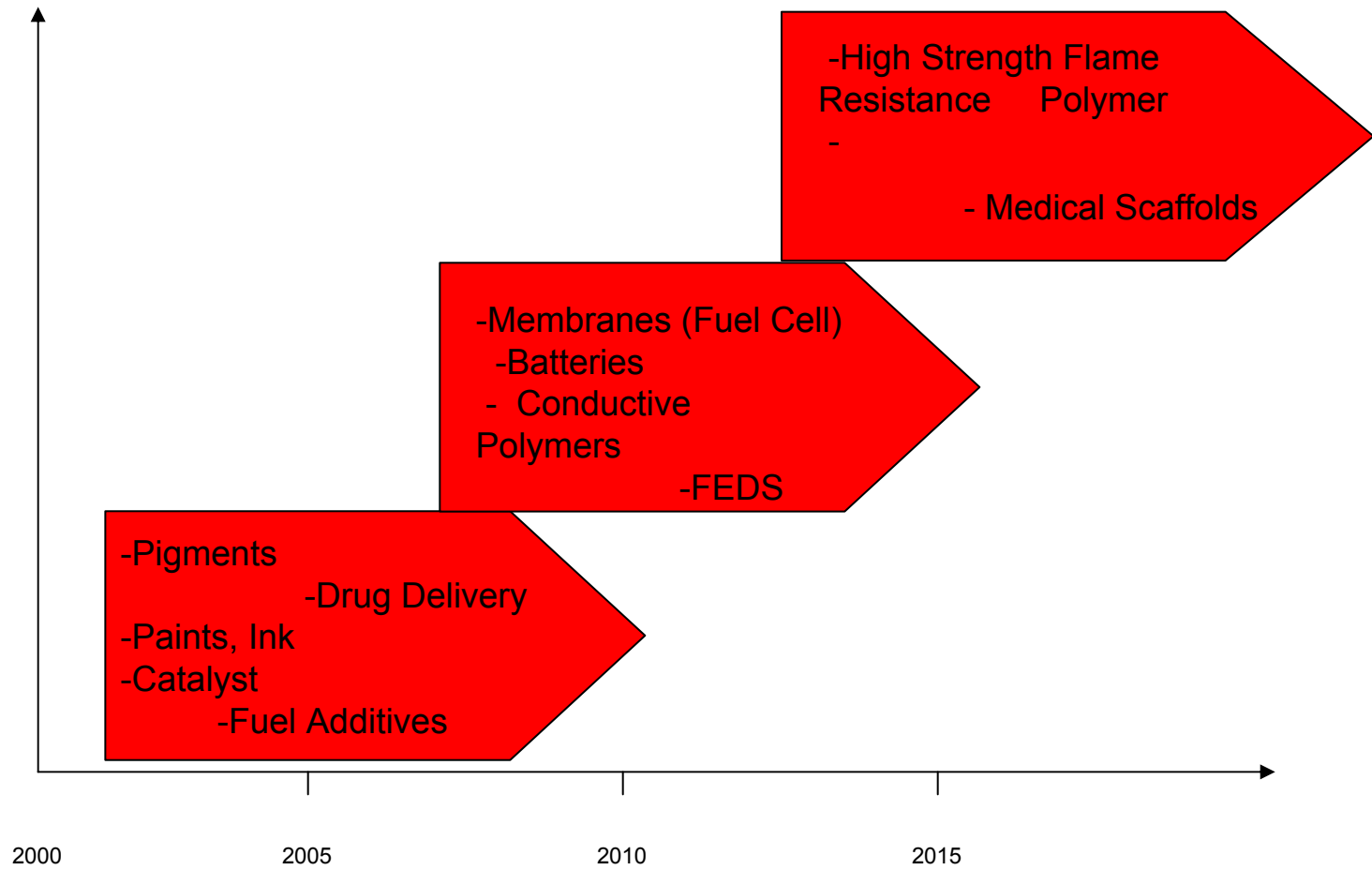
- Speaker 1

Dr. J Malcolm Wilkinson

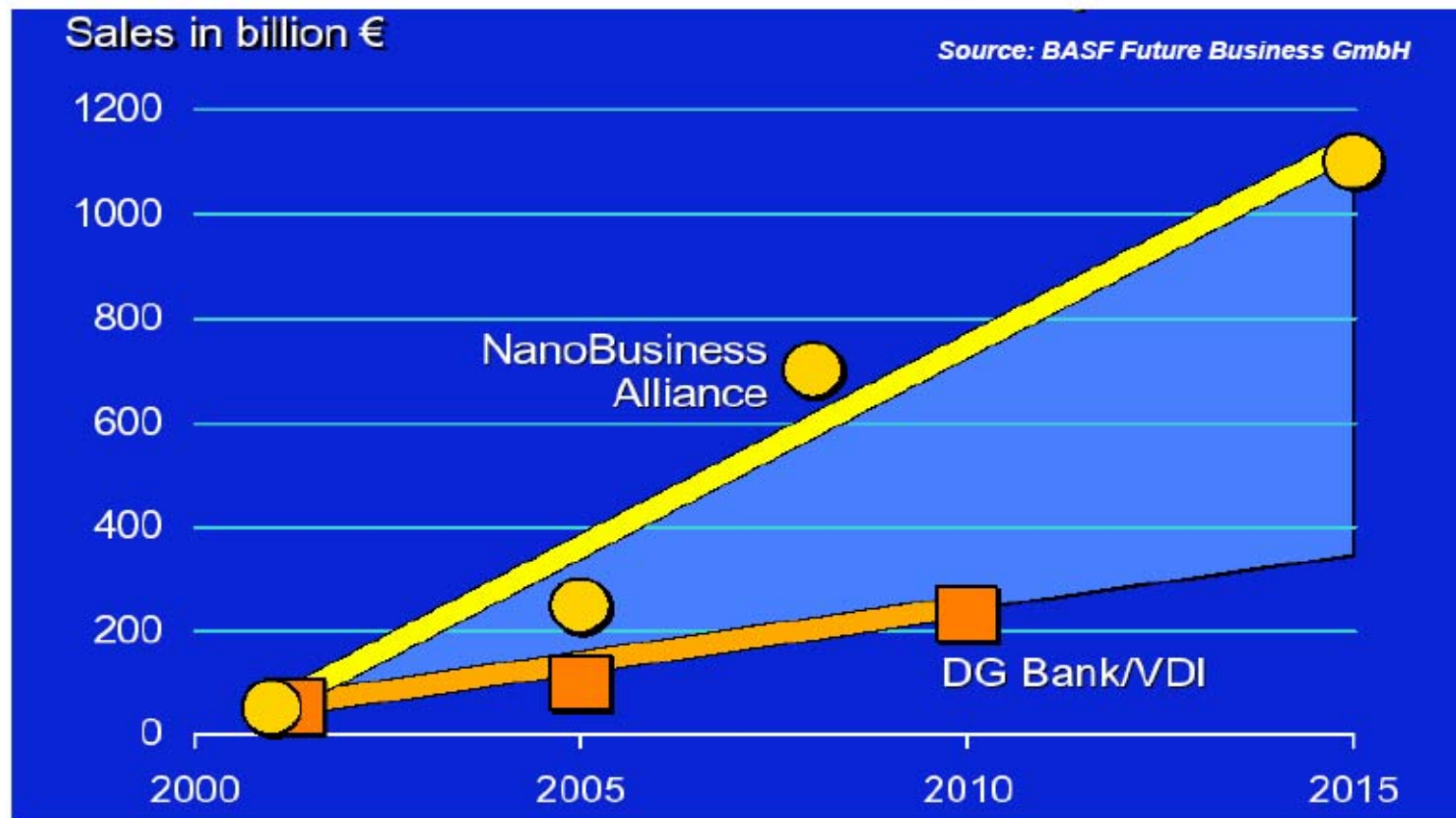
Overview of Current Applications of Nanomaterials



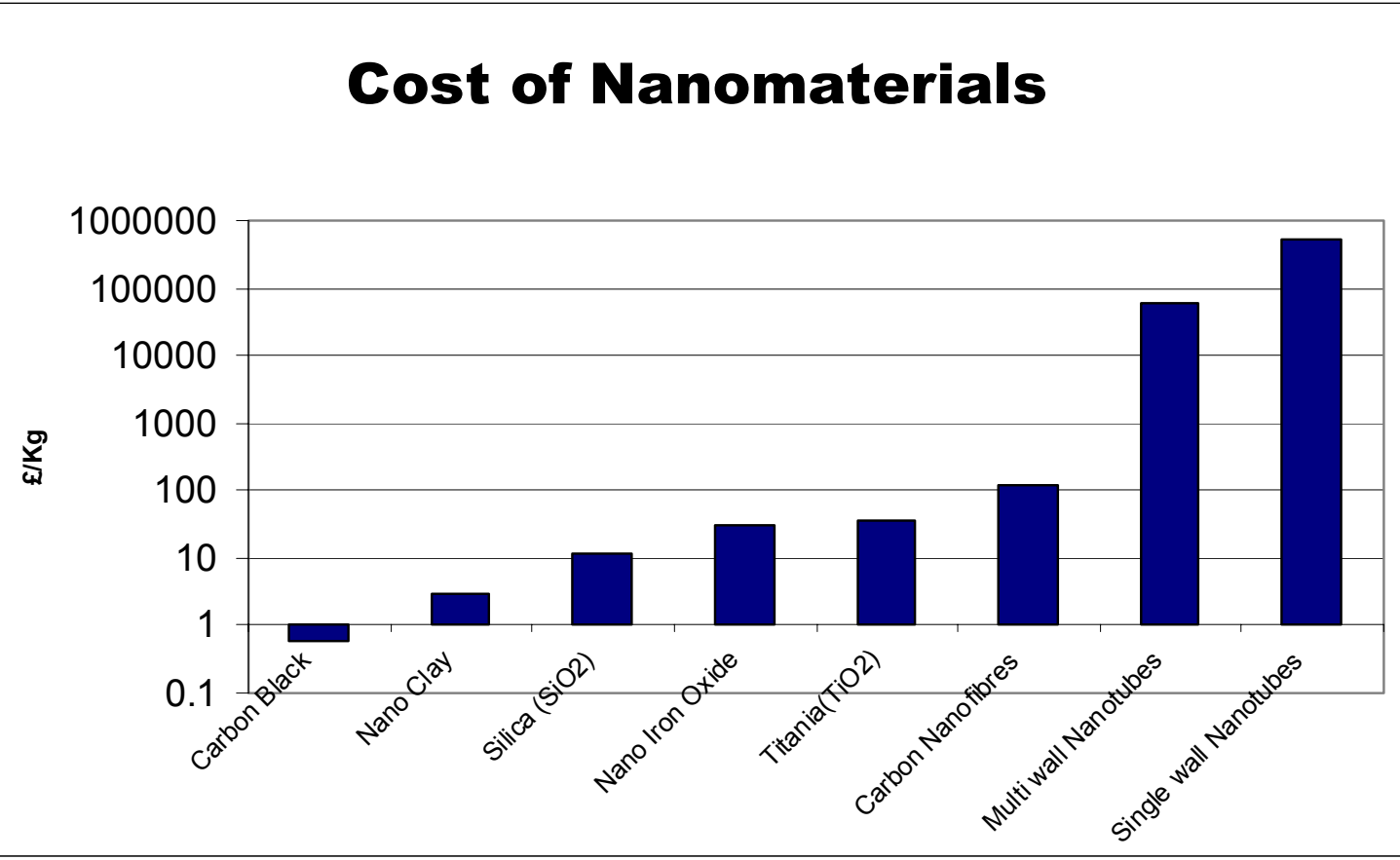
Timescales To Reach Production

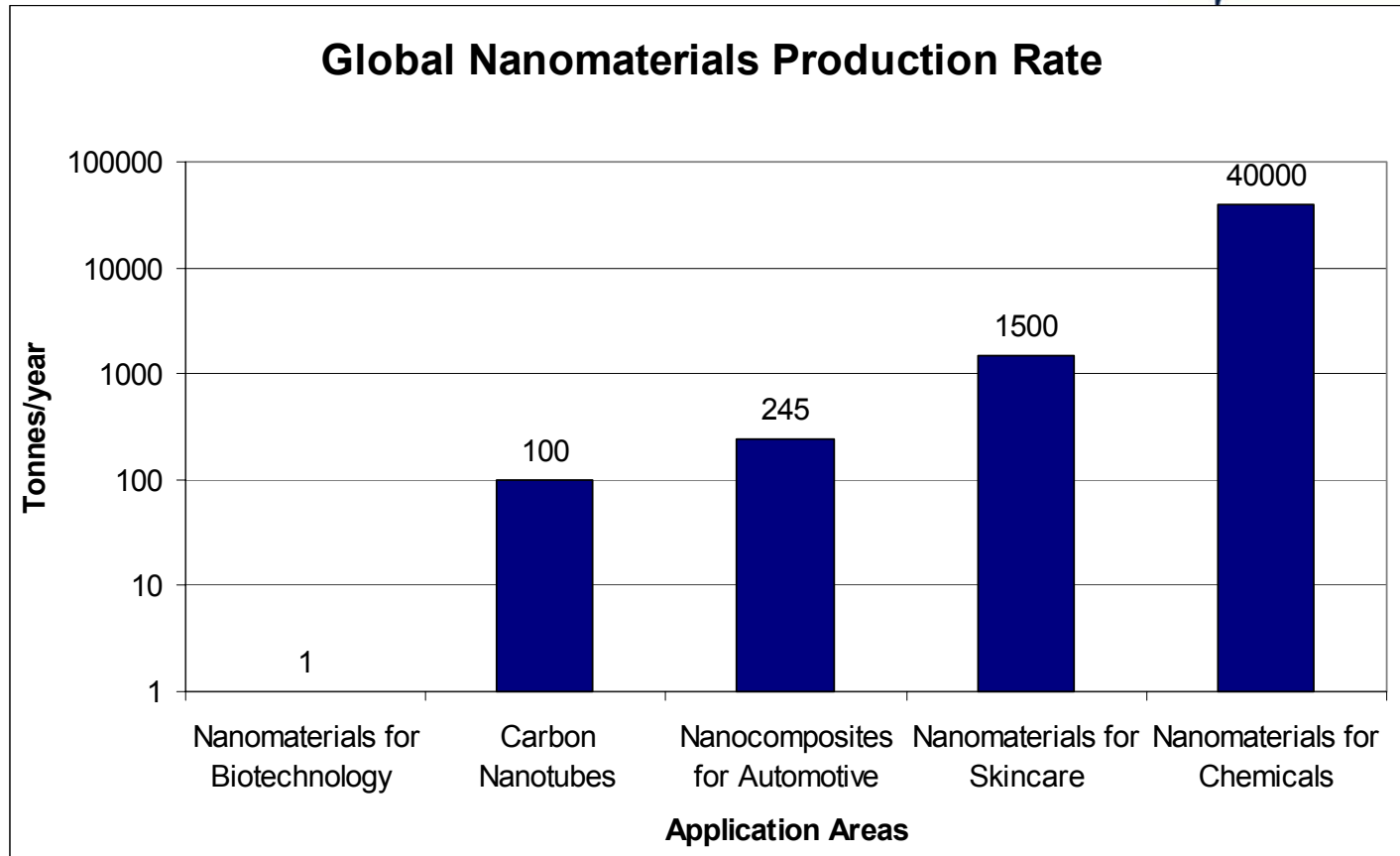


World market for nano/nanomodified products

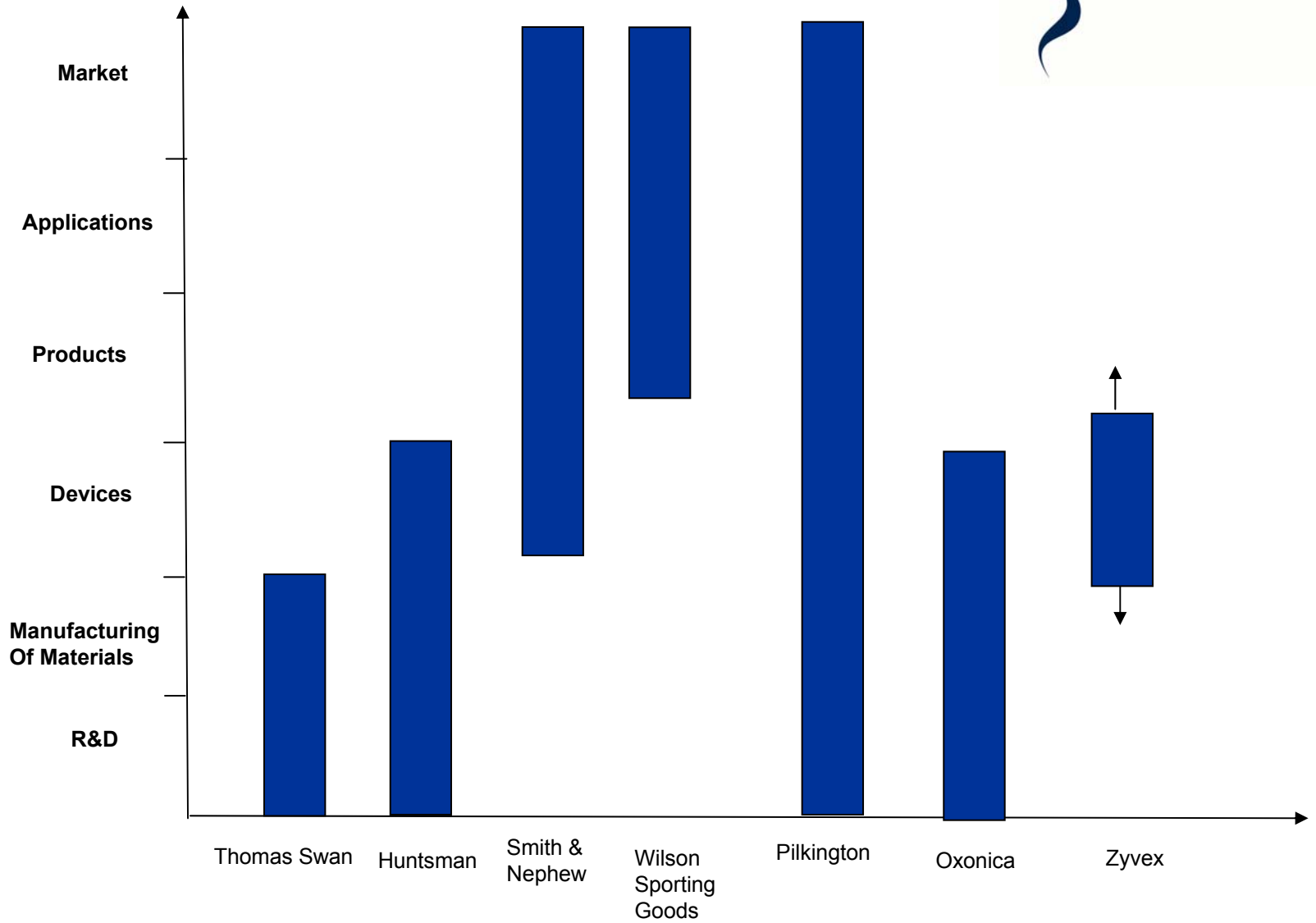


Cost of Nanomaterials





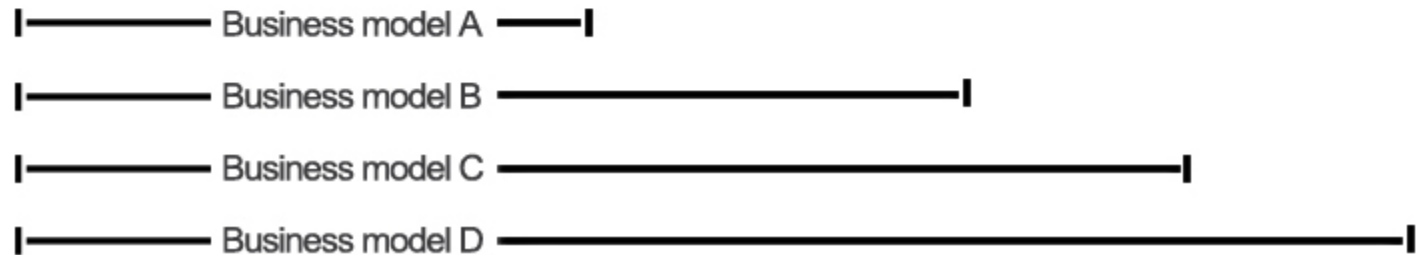
Nanomaterials Supply Chain



Zyvex – stepwise evolution of a business model



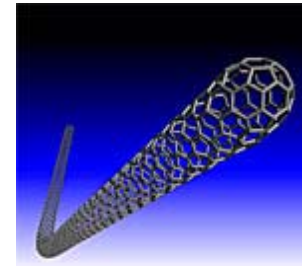
Nanosolve™ Value Chain



Sector	Examples of Applications	Examples of Companies
Biotechnology	Drug Formulation	Alza Corp
Carbon Nanotubes	R&D on Materials	Thomas Swan
Automotive	Light Weight Body Panels	Vantage Polymers
Skincare/Healthcare	Sunscreens Drug Delivery Patches	L'Oreal Oxonica Smith & Nephew
Chemicals	Paints Pigments Inks	Huntsman Tioxide Avecia

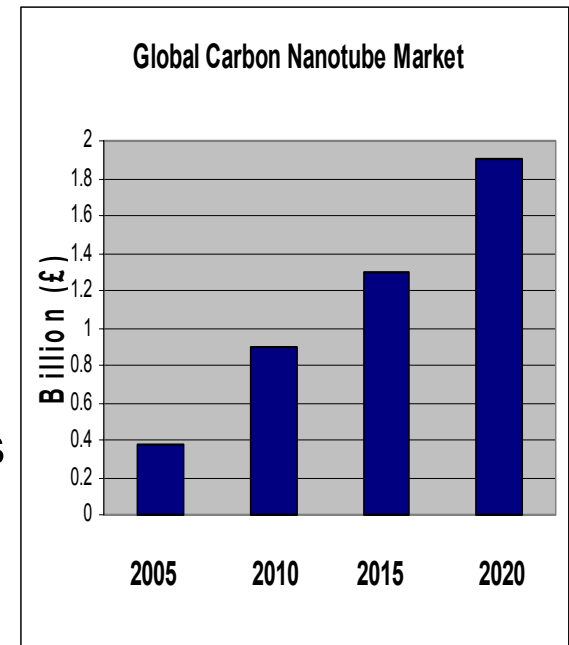
DTI Case Study: Thomas Swan Carbon Nanotubes

- Thomas Swan was founded in 1926 and is involved in manufacture and sales of specialty chemicals
- Carbon nanotubes are rolled up sheets of graphite (~1nm diameter) and have many potential applications including:
 - Electronics & displays
 - Composite materials
 - Hydrogen storage
 - Packaging & shielding
- Thomas Swan began commercial manufacturing (~4 – 5 kg/month) of single walled carbon nanotubes in April 2004 via chemical vapour deposition
- The material quality has been independently certified



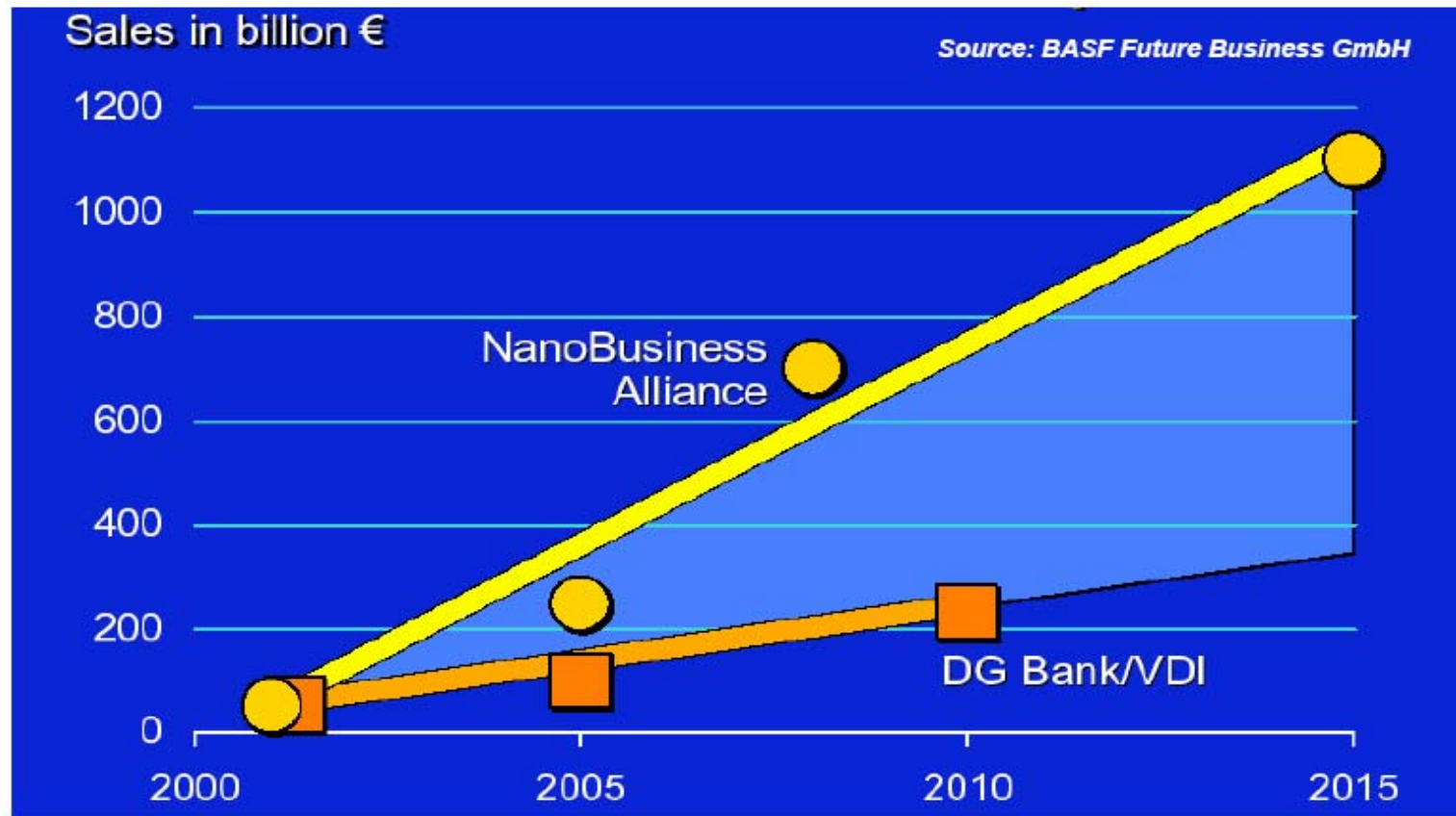
Benefits and Results

- Carbon nanotubes have remarkable properties:
 - 100 x stronger than steel by weight
 - Excellent electrical and thermal conductors
 - Potential for hydrogen storage
- The material properties are heavily dependent on the structure which is determined by the manufacturing process
- Are being developed for light and strong:
 - Body armour
 - Sports equipment
 - Aerospace parts
 - Car body panels
- Larger quantities of consistent material are required for investigation and use



Mitsubishi Research
Foundation

World market for nano/nanomodified products

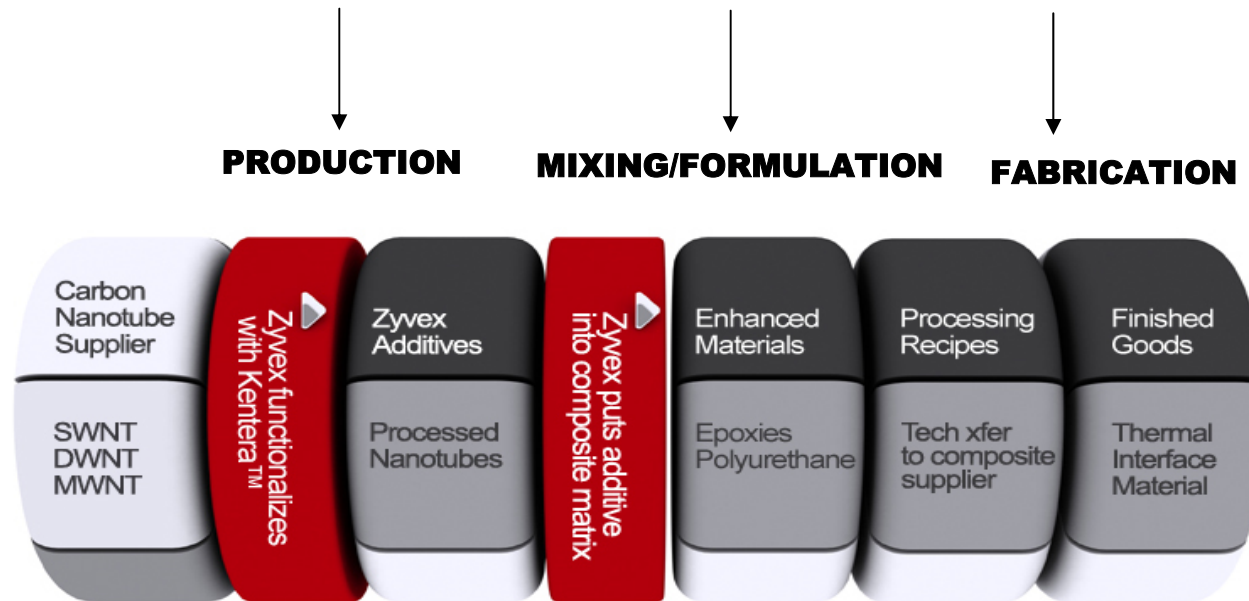


Commercialisation Method and Key Points

- Thomas Swan supplies a high value material with no IP constraints to customers (in contrast to some suppliers)
- The process was scaled from a lab to a commercial one by close work with Cambridge University for >5 years
- Further collaborative innovation regarding a 'spinning' reactor with improved purity and efficiency should sustain competitiveness
- Clear and well managed licence agreements with academic collaborators have been an important factor

Other Opportunities

EQUIPMENT MANUFACTURERS (e.g. RONDOL)



Rondol Technology : The Company

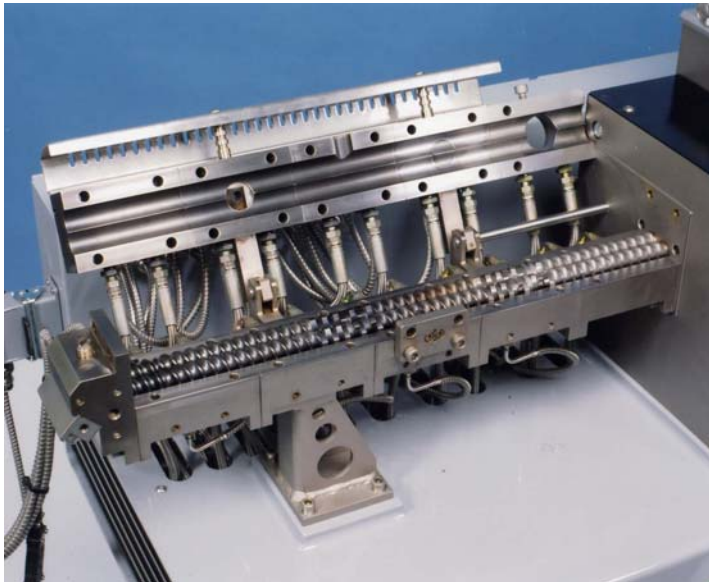
- The Company was registered 5 years ago
- Products : Precision mixing, compounding and micro moulding equipment
- Annual sales exceed £0.5 million

The Technology



The Technology

- Twin Screw Technology
- Micro-Moulding Technology



- Speaker 2
Dr. Graham Dransfield

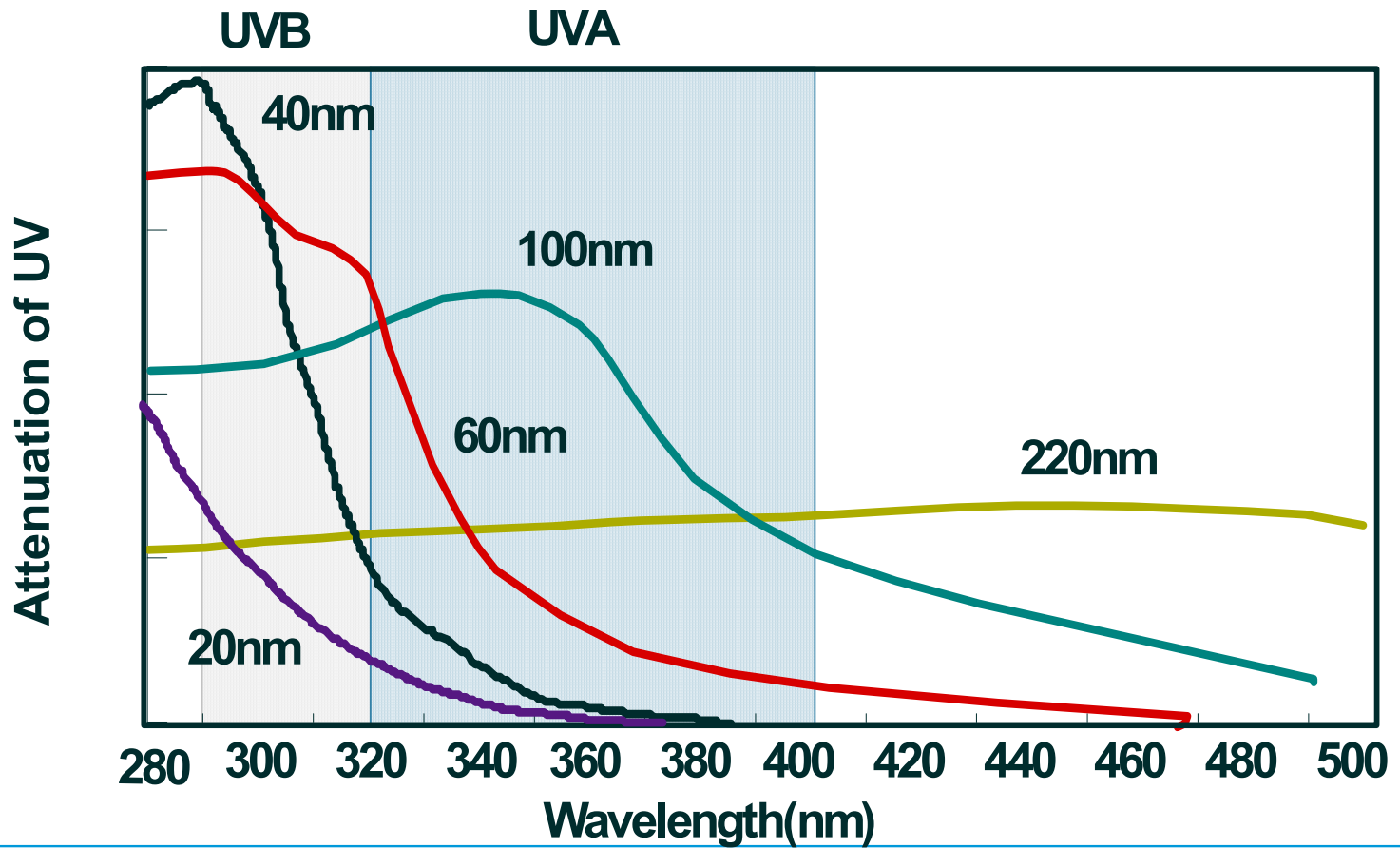
Nanotechnology and Titanium Dioxide



Cosmetics is a Very Active Area

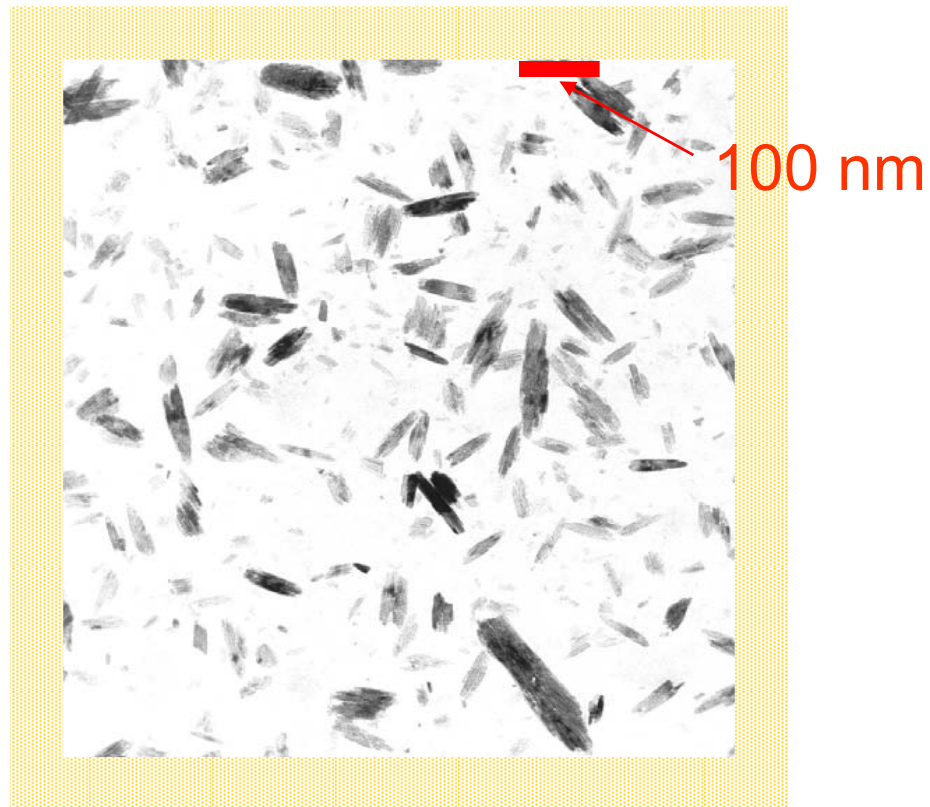
- Shampoos
- Skin Creams
- Sunscreens – TiO_2 in particular

UV Attenuation vs. Particle Size for TiO₂



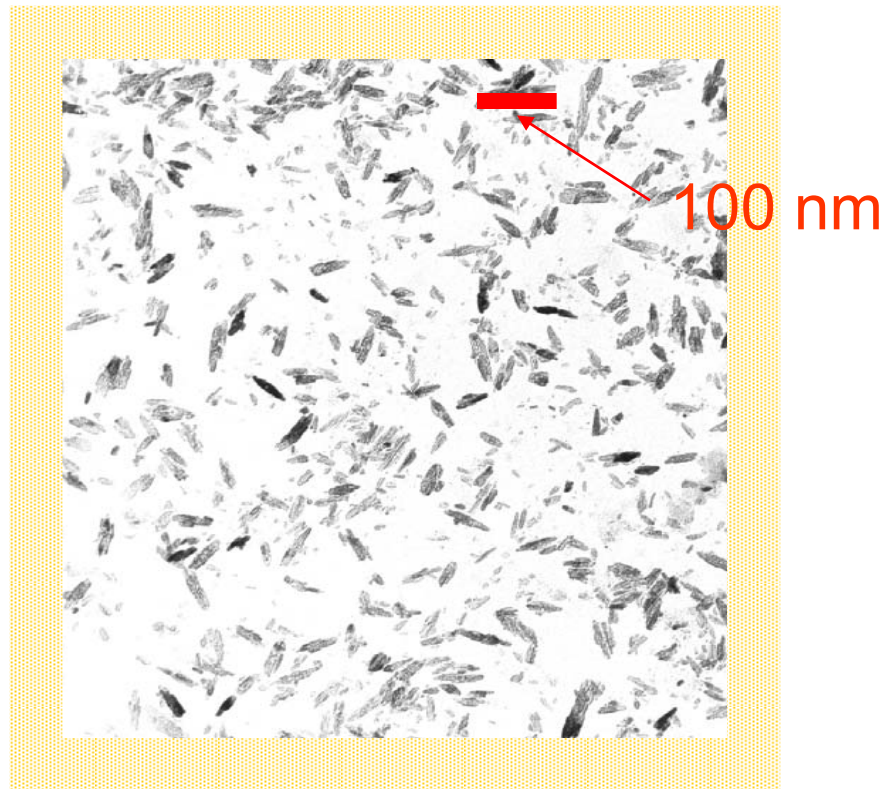
Nanotechnology and TiO_2 Sunscreens

The result: Conventional material



Nanotechnology and TiO_2 Sunscreens

The result: Step change material



Nanotechnology and TiO_2 Sunscreens

OVERALL RESULT:

STEP CHANGE TRANSPARENCY!

The Video Clip



Products Photo



Marketing Slide 2002 (source Kline)

- Total Market Size £138M
- Organic Sunscreen £113M (80%)
- Inorganic Sunscreen £25M (20%)

Data courtesy of Uniqema

Market for Sunscreen Active Ingredients 2010

- Total Market Size £150?M
- Inorganic Sunscreens value set to increase to £50M+ by 2010?

Mainly due to improvement in
transparency

Technical improvement offset by price
erosion of organics

Possible other Applications

- Plastics e.g. food wrapping
- Paints
- Wood varnishes
- Electroceramics
- Photocatalysts
- Solar energy
- Self cleaning glass

Conclusions

- Potential >£50M market for inorganic sunscreen ingredients
- Potential for wider (and larger) markets, including polymer packaging, through nanoscale additions
- Safety and regulation are important factors
- IP an important factor

- **Small things can lead to big money!**

THANK YOU FOR YOUR TIME

ANY QUESTIONS?