

Practical Use of Nano Carbons

Workshop focused on manufacture, use and disposal of CNTs.

Wednesday 17th August
NSQI, University of Bristol



Overview

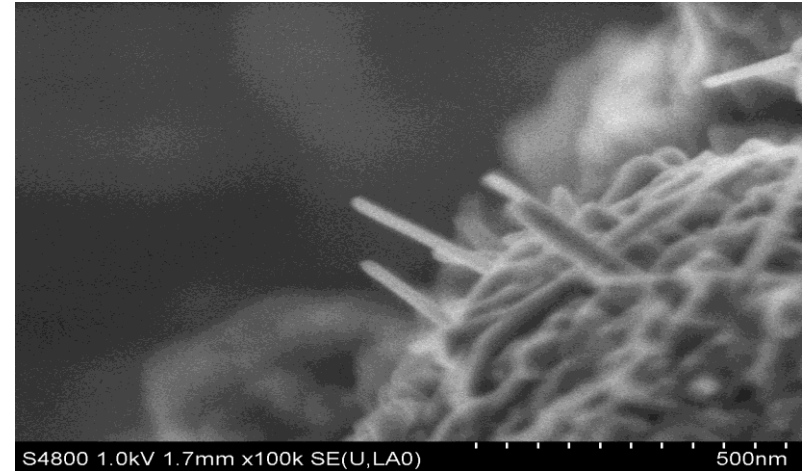
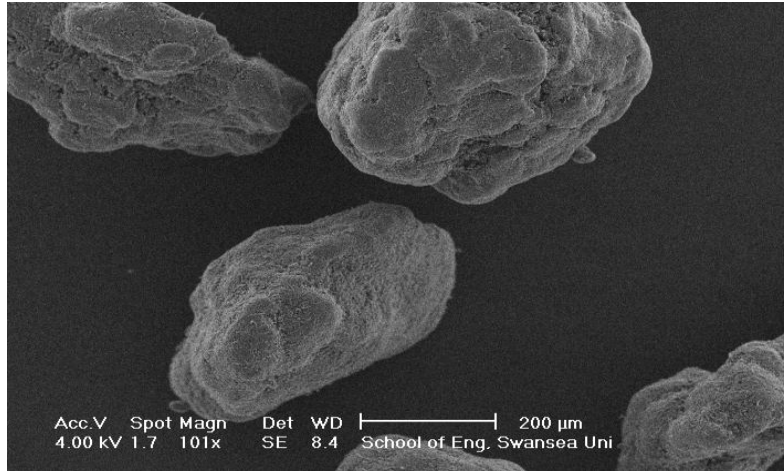
- Introduction – Haydale Ltd.
- What the law says and why?
- Shipping Guidelines
- MSDS Confusion
- Practical Steps to Reduce Exposure
- Other Recommendations
- Summary

Haydale Ltd.

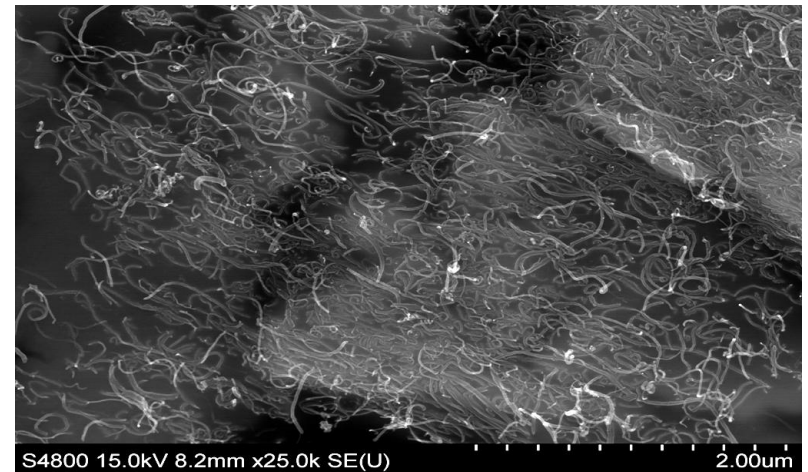
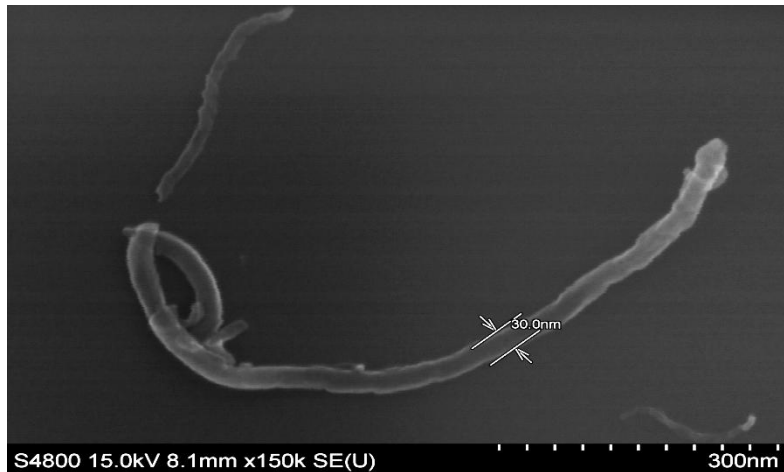
- Research and Development – CNTs and GNPs
 - Up to 1kg of CNTs per day
- **Plasma Functionalisation**
- De-Agglomeration
- Improved Dispersion
- Particle Characterisation
- Collaborative Partner

Haydale Ltd.

Before



After



Haydale Ltd.

2g samples of MWCNTs



Processing Time



Nanotechnology – The Law

- No Workplace Exposure Limits set UK or EU
- Take Precautionary Approach
- Risk Assessments
- REACH, COSHH, EPA Regulations

In essence, **everyone** who works with nanomaterials **has some responsibility** for themselves, those inside controlled areas, and the public in general.

10 Years on, no real answers

- Nanotube Characteristics
 - Length, Diameter, Number of Walls, Functionalisation
 - Chemically identical products with **infinite variation**
 - Suspect material descriptions
- Contaminants
 - **Metallic Oxides**: Zn, Co, Fe, Al
 - Other Carbons
- Batch to Batch Variations
- \$500,000 to get 1 material analysed

- Treat as Asbestos?
- How do CNTs compare to other chemicals?

Risk Assessment 101

- PPE is the last line of defence, use safe working practices and engineering measures
- Look for alternative materials
- Utilisation
 - Captured Materials – masterbatches, thermoplastic pellets
 - Wet Materials – dispersions, cakes
- Reduce/Remove dusting activities
- **Spills will happen**, develop a spills procedure

Shipping Guide Lines

- **Non-Hazardous**
- Include MSDS
 - CAS shipping codes, Graphite, Fullerenes, Oxides etc.
- **Label packaging**, and include: WARNING CONTAINS CARBON NANOTUBES, MATERIALS NOT FULLY TESTED
- Suppliers
 - Bayer – Drum
 - Nanocyl – Cardboard + Bag
 - Haydale – HDPE Container in Shrink Wrap
 - Others – Double Lab Bags, Plastic Containers, **Paper Envelope**

CNT Packaging



CNT Packaging



MSDS Confusion – Respiratory Protection

| Source | Respirator Details | Toxicological Information |
|-------------------------|---|--|
| HSE | HEPA Fume Hood APF 40 or above (P3), preferably positive pressure | Not Known but treat as toxic |
| Arkema | FFP3 | No Respiratory Information |
| Rosseter Holdings | Use Breathing Protection | Not Known |
| Baytubes | P2 | All exposures were tolerated without effect for the in-life observations |
| Nanocyl | FFP2 | Concentration Dependant Effects |
| Thomas Swan (SWCNTS) | P3 (full face) | Some evidence that CNTs of particular dimensions can cause adverse health effects. |
| CheapTubes Inc. | N100 or P100 Full Face | Inhalation may lead to the formation of lung Granulomas or possibly Mesothelioma |
| Blue Nano | Use suitable respirator when high concentrations are present | As Graphite |

Practical Steps to Reduce Exposure

- Personal Hygiene
 - Wash Hands, Blow Nose, Rinse Mouth, Shower Body
- Laboratory Cleaning Routine
- **HEPA Air Conditioning Units**
- HEPA Local Exhaust Extraction
- Double Door Entry
- -ve Pressure Laboratory
- Open packaging in a controlled environment

CNT composites

- ARKEMA - doesn't present any specific health risk when using in thermoset processing
- Nanoledge – No Risk
- Incinerate at end of life

- How well are these materials captured?
- Can we cut up a nano-composite safely?

Where to look for help?

Industry

- Pharmaceutical, Food/Dairy, Allergies Industry
- Clean Room Technology
- Nanomaterials Suppliers

NGOs

- PACTE, **Goodnanoguide**, HSE, COSHH Essentials, IRSST, ENPRA, NanoSafe, CORDIS, NanoTEST, Universities,

NANOWERK Website

Other Recommendations

- Don't tread these materials outside of your controlled environment
 - Disposable over-clothes etc.
 - Tack Mats
- Introduce Health Monitoring
 - Lung function tests etc.
- Implement a fair use policy
- Air Quality Monitoring???
 - Position **SEM sticky pads** around the lab and corridors

Where does this leave us?

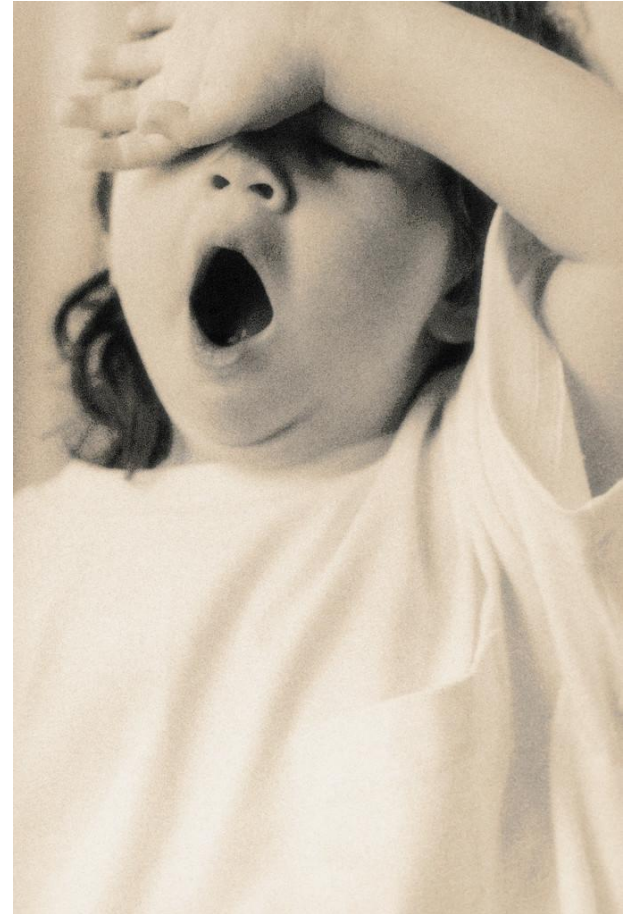
- Will CNTs go the way of Asbestos?
- Are we desperate need of standardisation?
 - Testing Procedures
 - Materials Descriptions

Summary

- Treat manufacturers data with a pinch of salt!
- Open containers with caution
- Utilise the **community**

Thanks for listening

Any Questions?



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