

Nanotechnology Design Space

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1 Definitions

SCU The smallest complete, controllable and significant unit which contributes to the functionality of the process at the nanoscale.

Size Scale The average size of the SCU.

Scale: $[0, \infty)$ nm

Dimensions Controlled The number of dimensions controlled in the manufacturing process.

Scale: 0-3

Example: Ball milling (0 controlled)

Degrees of Freedom The number of attributes the SCU can control.

Scale: 0 +

Example: Insulation protein can envelop nanoparticles and leave it's "holder" open or closed on demand.

Assembly Reliability The reliability of perfect duplication.

Scale: $[0, 1]$

Example: Ball milling (0) and photolithography (1)

Active Whether the SCU, by any means, causes a change in a separate atom that involves a change or movement of a particle not including an electron, photon or phonon.

Scale: Active/Passive

Macro Infrastructure Size How closing the SCU's can be packed or the largest factor when it comes to the size of the infrastructure needed to run the nanotech.

Scale: $[0, \infty)$ nm

Self Replication Self-explanatory

Scale: Yes/No

2 Other Definitions

State of the Art How close the technology is to being completely commerciable. *Commerciable* is when it can be mass manufactured and profitable.

Scale: 1-4

1. Theory
2. Prototype
3. Manufacturable
4. Commercial

Use -

Tool a macro scale device that manipulates at a nano level

Example: AFM

Device a manufactured nanoscale object

Example: CNT

Nano tool a nanoscale device that can function as a tool

Example: self-replicating nano machine (theoretical)

Assembly Method -

Bottom-up Lowest level components made first and combined into higher level components

Example: SAMs

Top-down Approach which takes a larger block of material and whittles away what isn't needed

Example: Ball milling

Combination A process which uses both forms of creation

Example: Photolithography

Bio-Integration Whether or not the SCU has the ability to interact with naturally occurring or commercial biological materials.

Scale: Yes/No

Self Replication Self-explanatory

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3 Evaluations

3.1 Nano-Technitude

1. Size scale
2. Dimensions controlled
3. Assembly reliability
4. Active

3.2 Danger Metric

1. Active
2. Biological integration
3. Size scale
4. Use

4 Applications

1. Medical diagnosis
2. Optics
3. Increasing mechanical strengths (ex. Light bullet proof vest, stronger textiles, stronger bricks)
4. Sensors (gas detection, gas classification)

5 What is Nanotechnology?

The technology that pertains to the controlled manufacturing or application at the nanoscale.