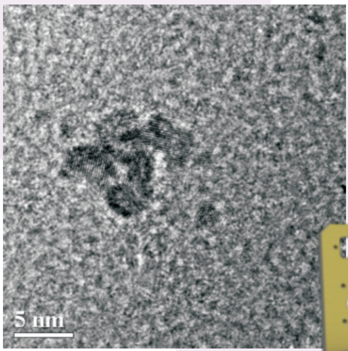
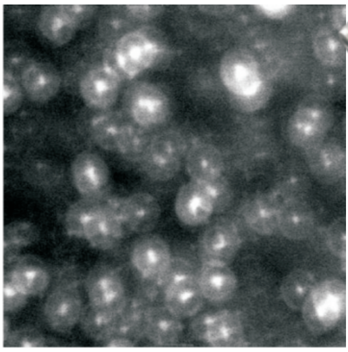
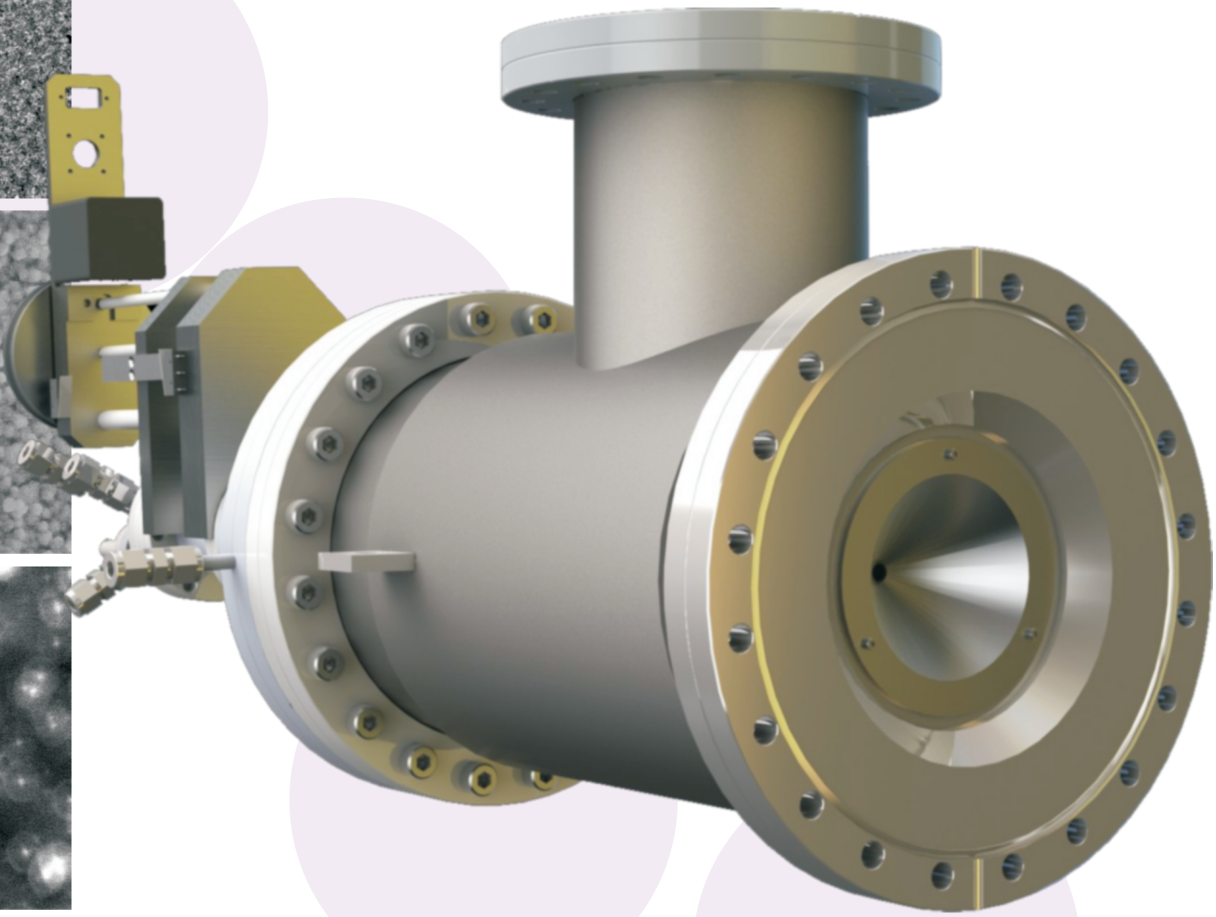
NanoGen50

Nanoparticle source







Features

- Negatively charged nanoparticles
  (bias control)
- Well defined nanoparticle beam
- Nitride and oxide compound nanoparticles
  (core-shell option available)
- Nanoparticle size range 1-20 nm
  (depending on material)
- Size variation +/- 5%
  (flow/power dependent)
- Non-thermal process
  (coating of delicate plastics and organics)
- Deposition rate 6 A/s

Applications

- Thin-film solar cells
- High-efficiency photovoltaics
- Gas sensors
- Catalysts
- Semiconductors
- Bio coatings
- Medical devices

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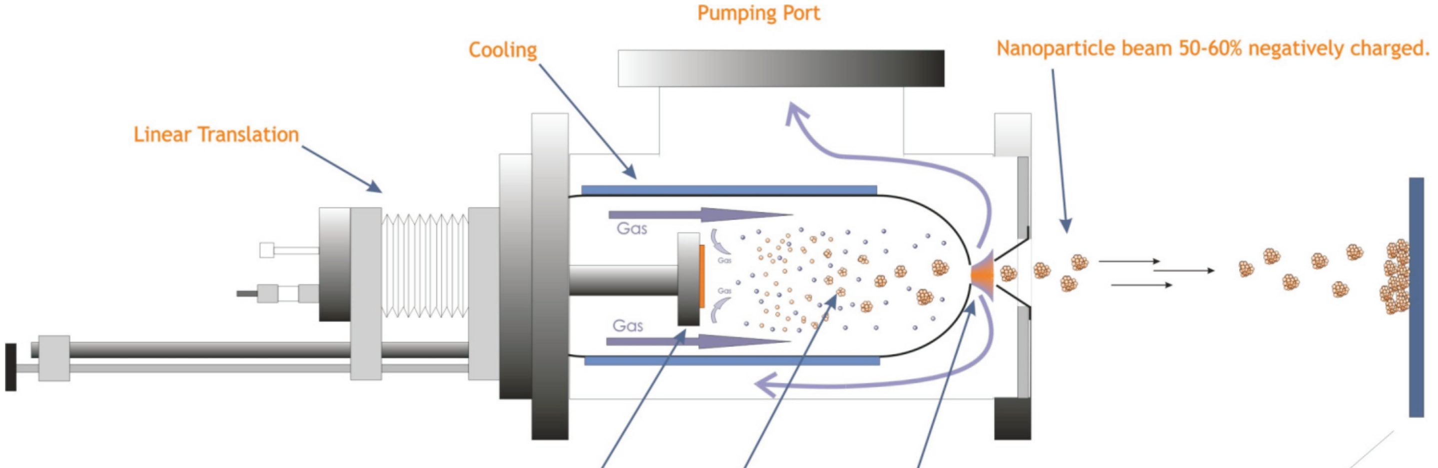
Nanoparticle deposition

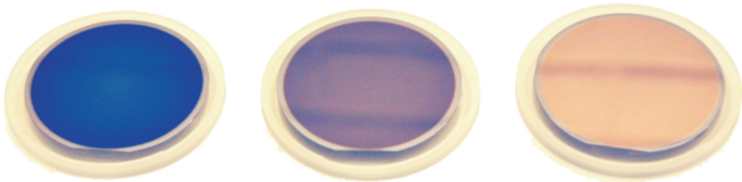


NanoGen50 nanoparticle source

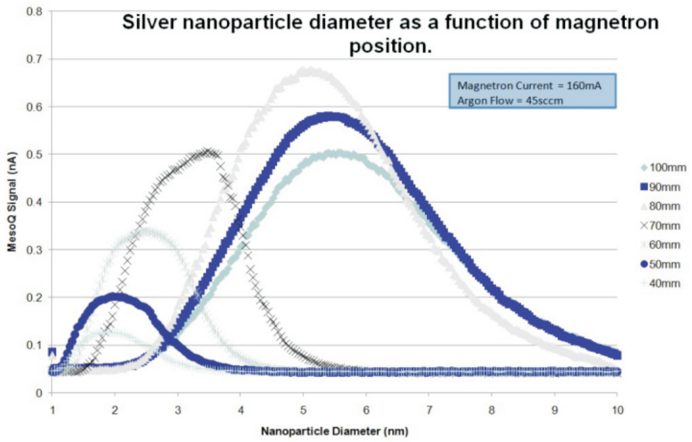
Nanoparticles (NPS) are produced by a 'terminated gas condensation' method. In this technique, a DC magnetron is used to sputter target material. The sputtered atoms enter the high pressure condensation zone where their mean free path becomes very small and they quickly thermalise. Nanoparticles are formed as these thermalised atoms migrate towards the expansion zone.

The NPS generated by this method tend to posses one additional electronic charge and this allows them to be electrostatically manipulated either through deflection, focusing or acceleration. The acceleration towards the substrate allows the particle impact energy to be controlled precisely. At low acceleration (<<1eV per atom) the particles soft-land without deformation. At higher energies they undergo a small degree of interface mixing and form a layer of bound nanoparticles. At very high energy the particles fuse to revert to bulk material. Such nanoparticle manipulation produces a wide variety of coating morphologies from nanoparticle powder, through porous films to crystalline structures.

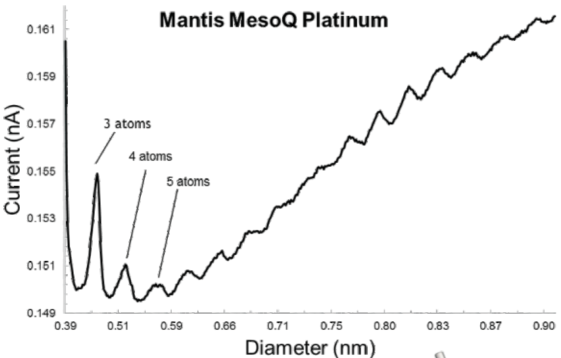
Effect of bias (5 nm Cu on GaAs)



300 V 1000 V 4000 V

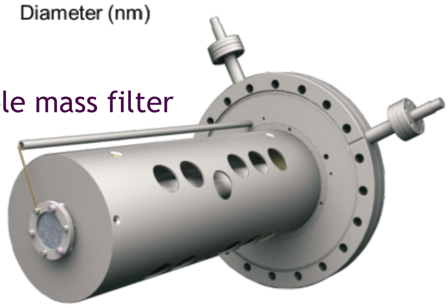


Mass spectra of silver nanoparticles



The gas flow characteristics within the condensation zone ensures refinement of size distribution of the beam to allow precise definition of the particle size in the emergent beam. The unique configuration of the condensation zone also maximises the ratio of nanoparticles to carrier gas entering the main deposition chamber. The source can be supplied with user-selectable refinement zones to suit particular applications. Nanoparticles can be generated with as few as 30 atoms up to those with diameters close to 20 nm.

MesoQ quadrupole mass filter



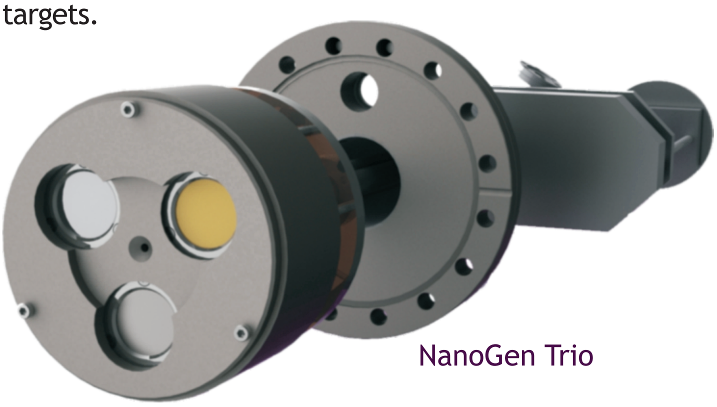
The MesoQ quadrupole mass filter can be used in line with the NanoGen50 to analyse and further filter the nanoparticle beam with throughput up to 10^6 amu. The quadrupole has an ultimate size resolution of 2% filtering mode, allowing precise particle size definition to be achieved. It is supplied as standard with software control for analysis from a windows-based PC.

Compound materials

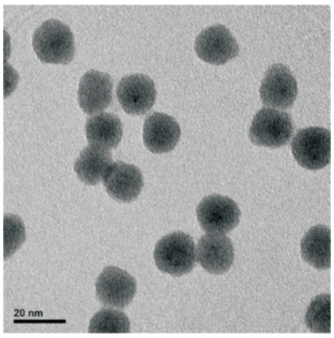
Deposition of compound nanoparticles

Compound nanoparticles such as oxides, hydrides and nitrides can be grown by adding a small amount of the reactive gas to the aggregation zone of NanoGen50. It is possible to control the mole fraction and (thus physical properties of material) of additional element by control of the partial pressure.

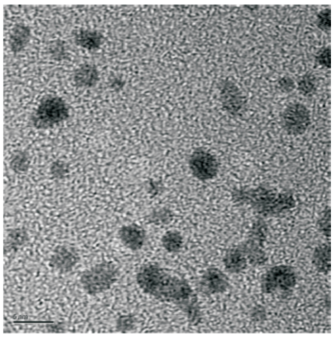
NanoGen Trio has three independent coplanar targets, which allow deposition of complex alloy nanoparticles. It is achieved by a precise gas flow control to create rapid mixing of atomic vapour sputtered from different targets.



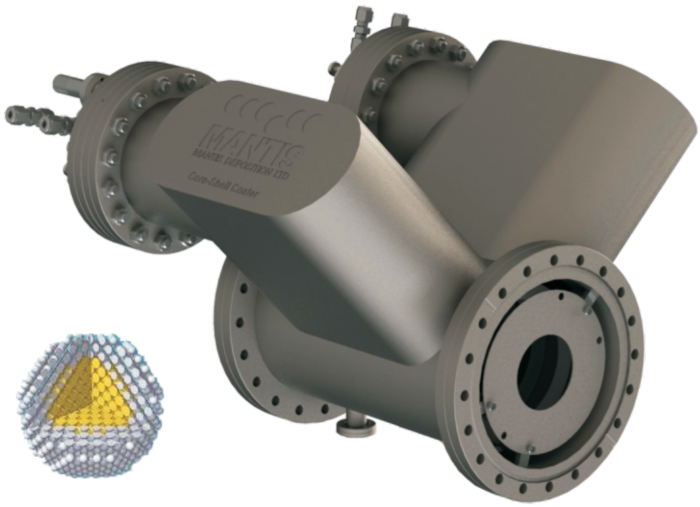
NanoGen Trio



TEM image of TiO_2



TEM image of Pt/Ru



Nanoshell

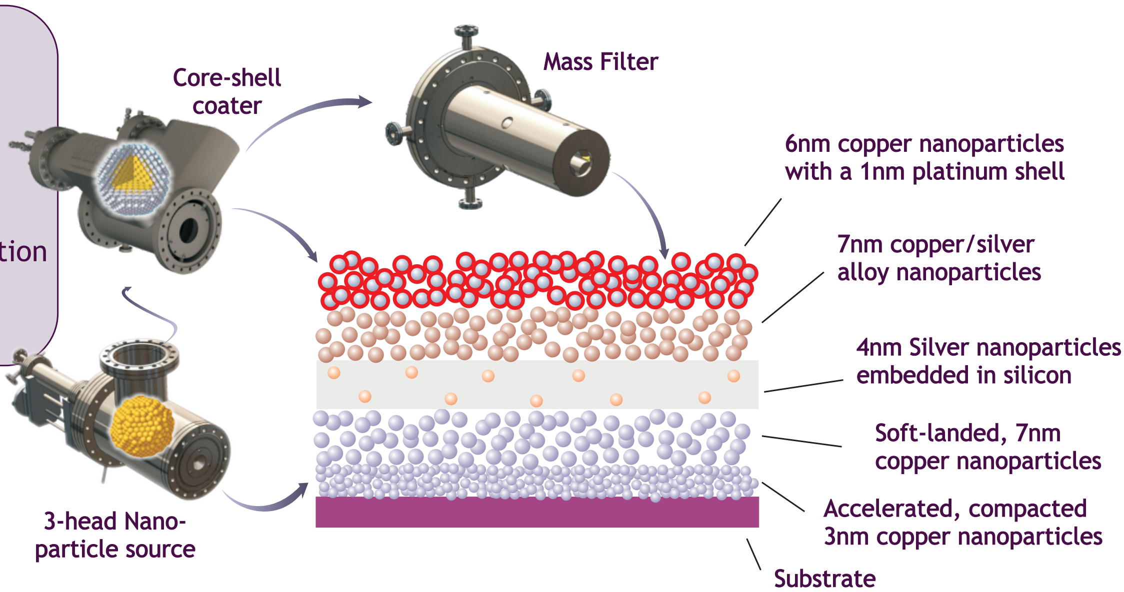
Coreshell nanoparticles

Coreshell nanoparticle has a core of one material surrounded by a shell of another material. The composition of the core and the shell can be varied and this presents an opportunity to create structures with combinations of properties that neither individual material posseses. These unique properties find their use in numerous biomedical applications, gas-sensing, quantum dots, etc.

Nanoshell coater is comprised of a chamber and a linear magnetron source mounted at the top of it. When it is placed in-line with Nanogen50, the nanoparticle beam coming out of the nanoparticle source enters the Nanoshell chamber, where it travels through the vapour generated by a linear magnetron source and becomes coated with the sputtered material. To ensure more efficient coating, the beam is collimated and decelerated by a series of electrostatic lenses. The resulting coreshell coated nanoparticles could be deposited on a substrate.

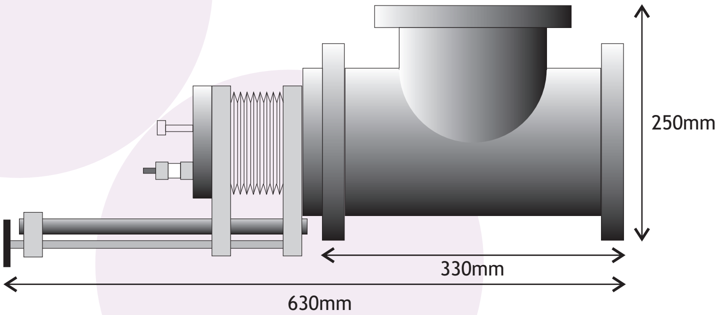
Within the SAME coating run it is possible to control:

- Particle size
- Film density
- Particle composition
- Shell material around core



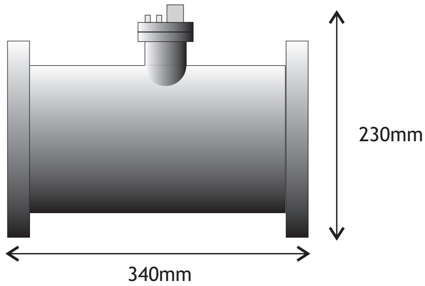
Specifications

NanoGen50



Mounting flange	NW150CF / 8”
In vacuum length	0
Cluster range	1-20nm (material dependent)
Size variation	+/-5% (flow/power dependent)
Deposition rate	6 Angstroms/s (Max.)
Gas flow	5-100 sccm Ar/He
Cooling	Water / LN_2

MesoQ



Mounting flange	NW150CF / 8”
In vacuum length	0
Resolution	~2%
Mass range	2 - 10^6 a.m.u.
PC Interface	A/D (Software included)

Accessories

Full NanoGen Automation -
The NanoGen50 can be offered with full automation including motorised linear feed, power control and gas control.

Optical plasma monitoring -
The plasma conditions can be monitored using an integral optical fibre and accompanying spectrometer. PC Software and USB interface are included.

Beam Steering -
The source can be fitted with beam-steering plates for manipulation of the ionic content of the beam

OTHER: Manual Teardrop Shutter, Automated Teardrop Shutter.

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