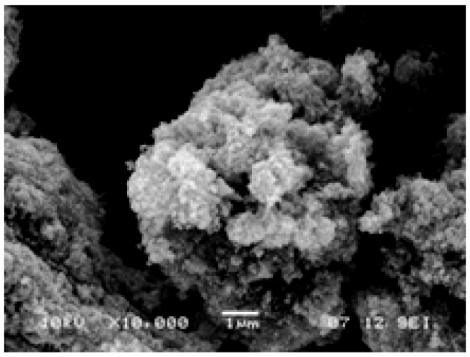
NANOPARTICLES PRODUCTION

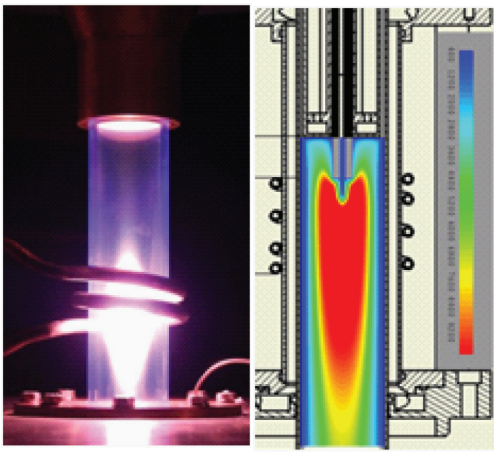
Nanoparticles, or ultra-fine particles, have one dimension that is 100 nanometers or less in size. The increasing interest in nanoscale material stems on the fact that the properties of many conventional materials change when formed from nanoparticles. This is typically because nanoparticles have a high surface-area-to-volume ratio; this causes them to be more reactive to surface driven process. Today, nanoparticles are used, or being evaluated for use, in many fields such as optical, magnetic, thermal, mechanical, electronic, energy and biomedical.



Agglomerates of SIC nanoparticles (Sirris picture, NanoTech project)

NANOPARTICLES SYNTHESIS PROCESS

A research group has been created at VKI to work on the synthesis of high-quality metallic and ceramic nanoparticles by radio frequency (RF) thermal plasma process. In this process, the precursors materials are first evaporated in a plasma torch and then the nano-sized particles are formed thought nucleation and are growing by condensation and agglomeration as the vapor cools down in a quenching chamber. The major advantages of this process are the high purity and thermal stability of the produced nanoparticles and the high flexibility in the selection of the precursors.



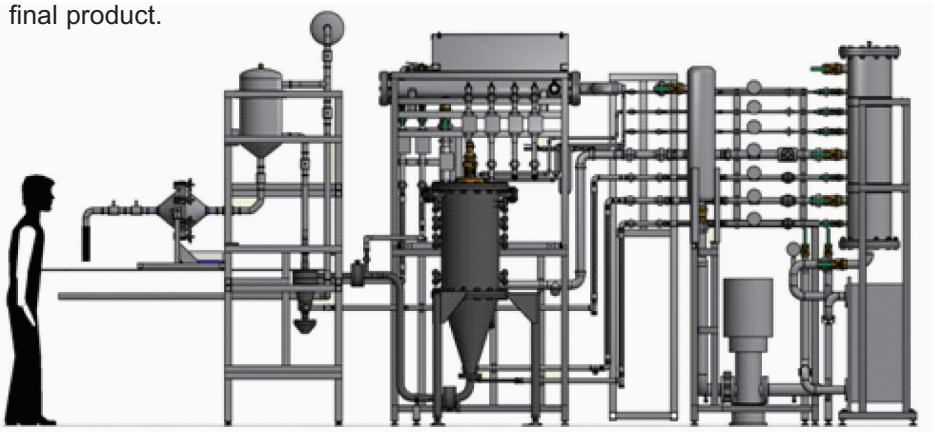
Plasma torch (Experiments and modeling)

RESEARCH ACTIVITIES

Actual research activities at VKI are mainly focused on the development and validation of numerical tools to simulate the evaporation of the solid precursors in the plasma torch and the formation of the nanoparticles in the quenching chamber. These tools are developed into an Open-Source CFD software. Advanced optical tools are also developed in order to assess in real-time physical quantities (plasma core temperature, nanoparticle size and concentration) which are important to control the synthesis process.

FULL SCALE PROTOTYPE UNIT

In the framework of the NanoTech project supported by the Walloon Region, VKI has designed and assembled a full-scale prototype unit to prove that the control and the repeatability of the nanoparticles quality are feasible at mass production scale. Special attention was also paid for the safety of the operators as well as for the conditioning of the final product.



Full scale production unit

① Cooling circuit

② Plasma torch

③ Quenching chamber

④ Cyclonic separator

Contact
Dr Jean-Baptiste Gouriet
gouriet@vki.ac.be
Phone: +32 (0)2 359 94 25