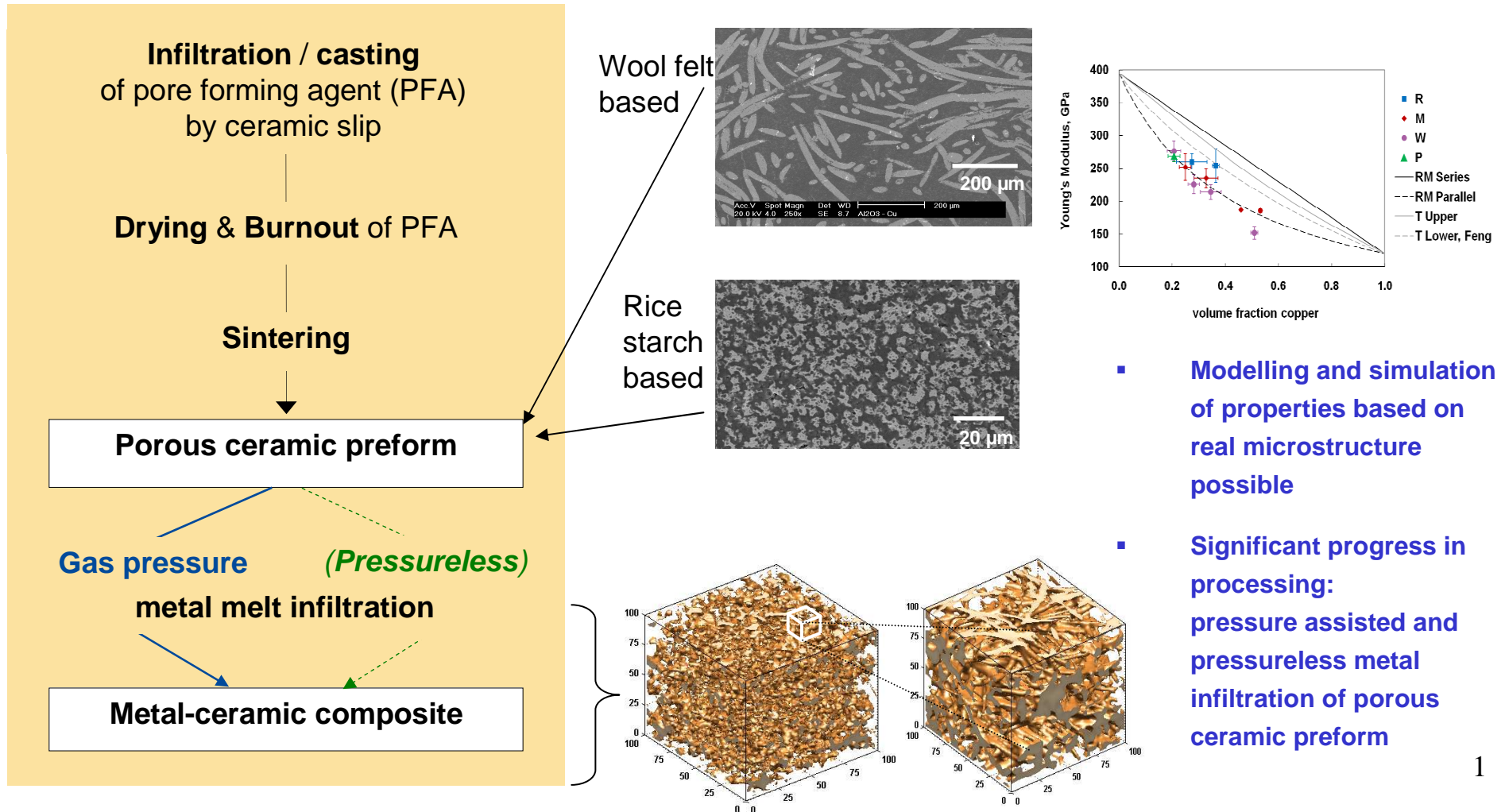




# Metal Ceramic Composites Based on Preforms (PREFORMCERMET)

Metal-ceramic composites with high wear resistance, high thermal conductivity, high strength for applications to at least 900 °C

→  $Al_2O_3$ -Cu metal ceramic composite with interpenetrating network microstructure



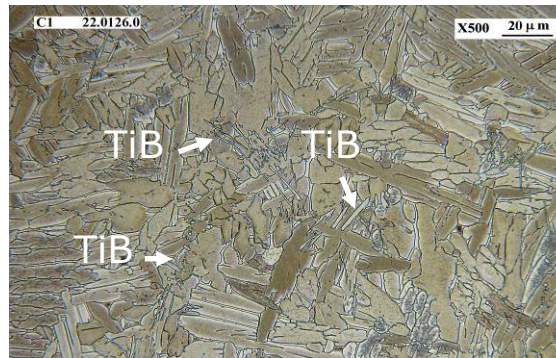
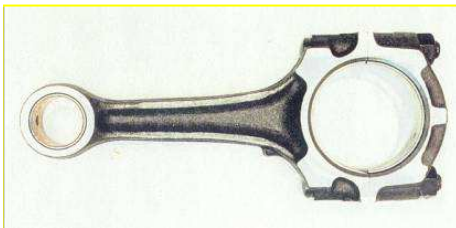
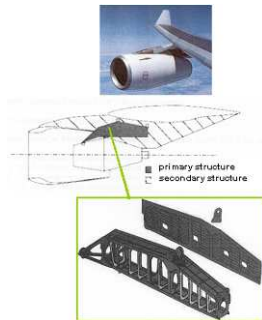


# New particulate Al and Ti matrix composites produced by self propagating high temperature synthesis (PartMMC)

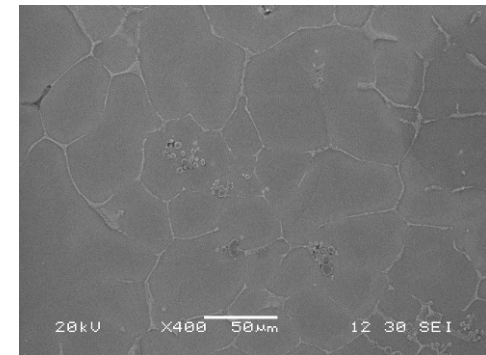
**Development of the SHS process for production of MMCs based on Al and Ti.**

→ SHS: synthesis of compounds in a wave of chemical reaction (combustion) that propagates over a starting reactive mixture owing to layer-by-layer heat transfer.

## TARGETED APPLICATIONS:



**Ti6Al4V + TiB**

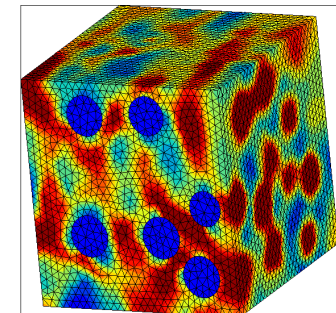


**Al-Cu4Mg1 + TiC**

## Mechanical properties

	E (GPa)	Rp0.2 (MPa)	Rm (MPa)	A (%)
Sample 0	144	848	921	7.3
Sample 1	157	805	902	7.8
Sample 2	147	884	886	7.3
Sample 3	159	785	881	7.4
Average	152	806	897	7.5

Multiscale modelling of the non-linear behaviour of MMCs



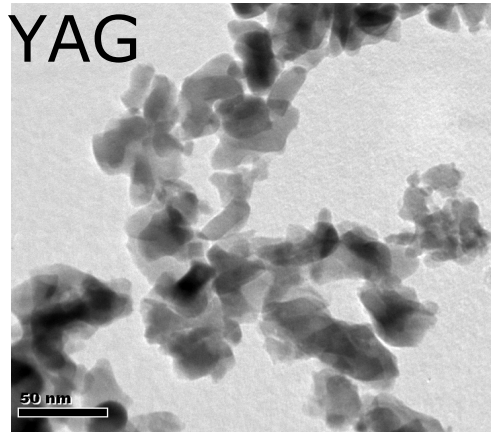


# NRT2-4 Metal-Ceramic Nanostructured Bulk Composites and Coatings (NANOCERMET)

## Development of novel metal-ceramic nanostructured multifunctional composite systems:

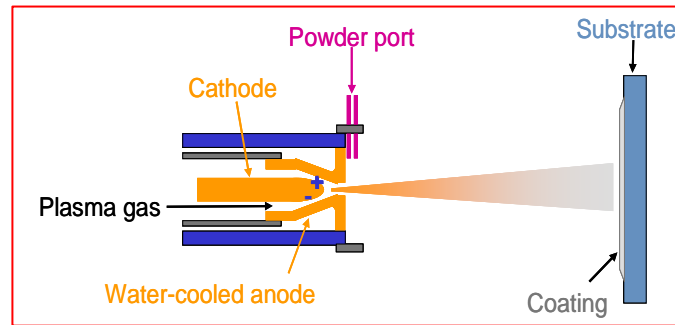
- i) model materials for basic research (nanoscience)
- ii) potential applications in technology and medicine

I) Wet chemical methods of synthesis of ceramic nanopowders



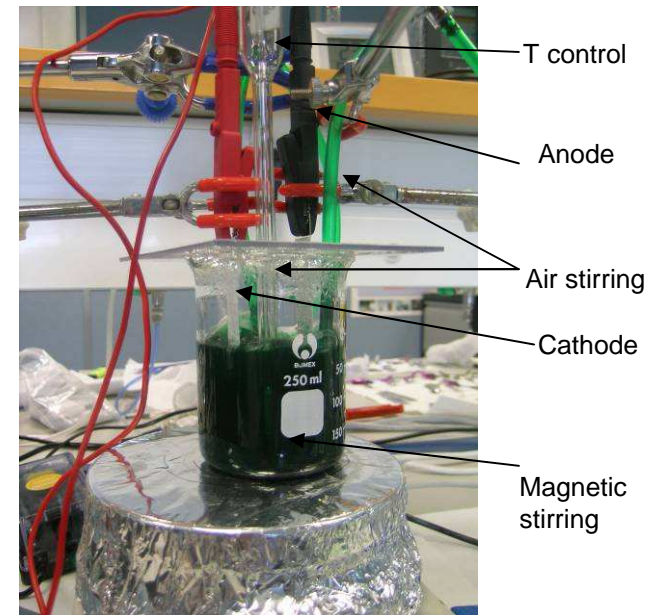
Surface area: 22 m<sup>2</sup>/g

II) Nanostructured ceramic coatings by atmospheric plasma spraying

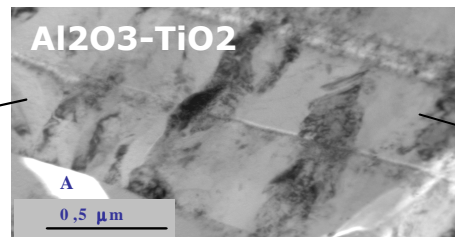


Oxide (Al<sub>2</sub>O<sub>3</sub>-13%TiO<sub>2</sub>) and non-oxide (WC-12%Co) coatings produced

III) Composite coatings by electrochemical deposition: Ni/SiC and Ni/Al<sub>2</sub>O<sub>3</sub>



Nanostructured coatings exhibit higher microhardness and better wear resistance than conventional (μm) ones.



**Pin-on-disk wear resistance tests**



Ti6Al4V alloy coated with conventional and nanostructured Al<sub>2</sub>O<sub>3</sub>-13%TiO<sub>2</sub> coatings.

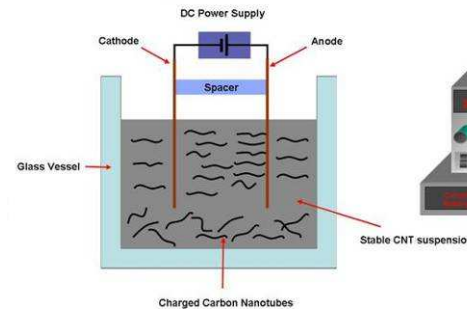




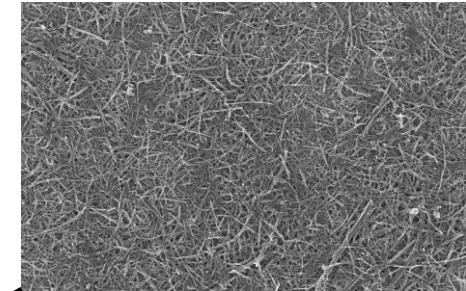
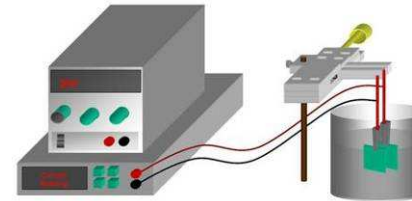
# NRT2-4 Metal-Ceramic Nanostructured Bulk Composites and Coatings (NANOCERMET)

IV) Carbon nanotube (CNT) containing composites (and coatings) by electrophoretic deposition (EPD)

Schematic diagram of EPD of CNTs

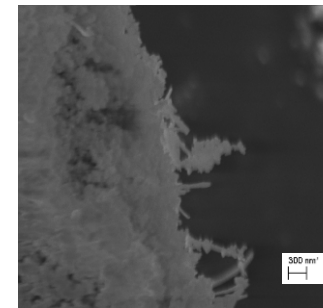
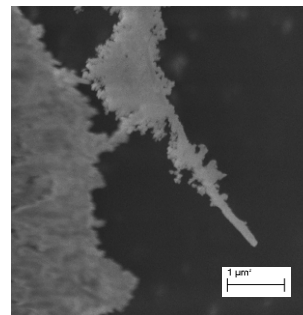
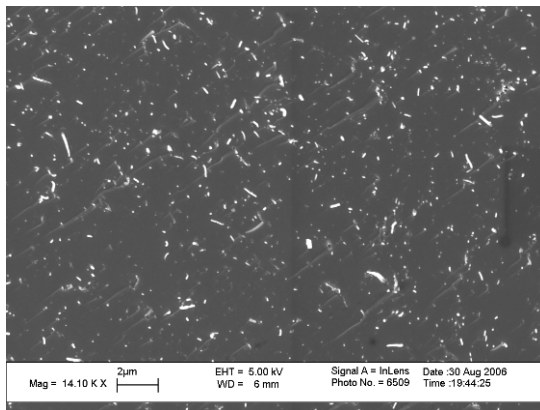


EPD cell

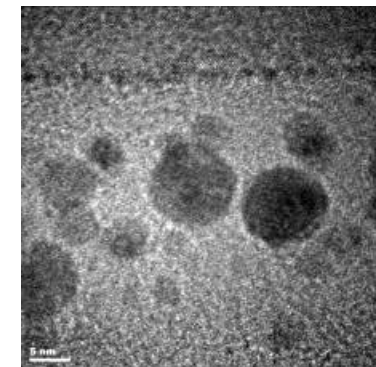


CNT deposit by EPD

**CNT/SiO<sub>2</sub> nanocomposite by surfactant assisted heterocoagulation**

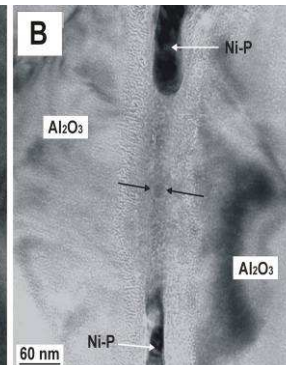
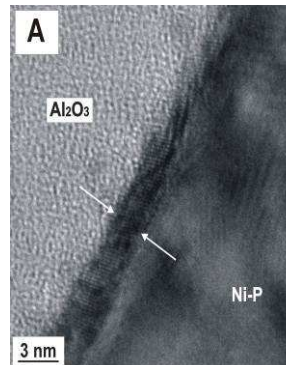
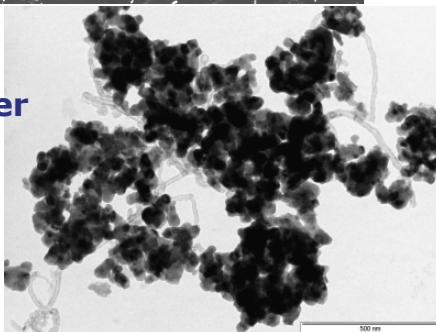


VI) Metal nanoclusters/silica composites by RF co-sputtering



V) Bulk alumina-metal nanocomposites by chemical electroless deposition of Ni-P

**Zirconia nanopowder /CNTs mixture**



**TARGETED APPLICATIONS: sensors, antibacterial layer**