Transmission Electron Microscopy Equipment (TEM)

IMOMEC
Institute for Materials Research
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Associated Lab IMEC

Transmission electron microscopy (TEM) is an imaging technique where a beam of electrons is passing through a thin specimen (typically hundred nm thick). Depending from the nature of the thin specimen (density, crystal structure, defects,…) a different amount of electrons will pass through. The transmitted electrons will form after magnification an image or diffraction pattern on the recording medium (fluorescent screen or CCD camera).

Despite the drawback of mostly the tedious specimen preparation, the TEM technique is very powerful due to the information which can be obtained at a very small scale (lateral resolution of some tenths of a nm in imaging mode). Especially the combination of imaging mode (BF : bright field; DF : dark field), diffraction mode and chemical composition obtained by EDX (Energy dispersive X-ray detection) is very powerful. The samples have to withstand also high vacuum conditions.

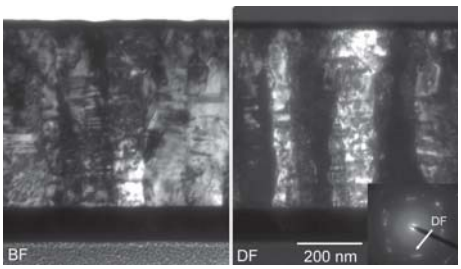
System description and specifications

IMOMEC has a Philips CM12 (S)TEM equipped with an EDX detector. A cryo-TEM transfer system and a heating stage allow the study of materials at a large scale of temperatures. Despite the lack of a FIB (focused ion beam) in IMOMEC, several specimen preparation techniques (e.g. cryo-ultramicrotomy, electrochemical polishing, ion beam milling, dispersions,….) are available to obtain electron transparent regions. Externally FIB prepared samples can also be investigated. Materials that have dimensions small enough to be electron transparent, such as (nano) powders can be quickly produced by the deposition of a dispersion on support grids.

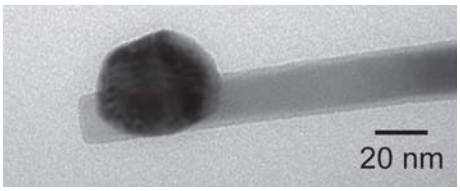
Measurement example

Some typical applications are :

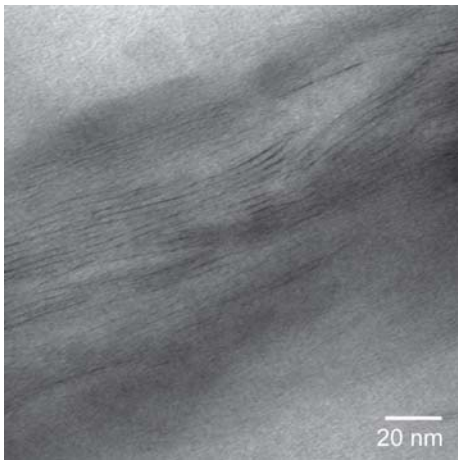
- Dimensional and crystallographic study of (nano)powders / dispersions
- Polymer films (conductive polymers, polymer with clay platelets,…)
- Interfacial study (diamond / Si : formation of SiC)
- Microstructure of metallisations (Cu film, interconnection line)
- Cryo-TEM study upon solutions
- Nanostructured hybrid material systems (TiO2 in conductive polymer; MDMO-PPV/PCBM bulk heterojunction solar cells) : planar view and cross-sectional view



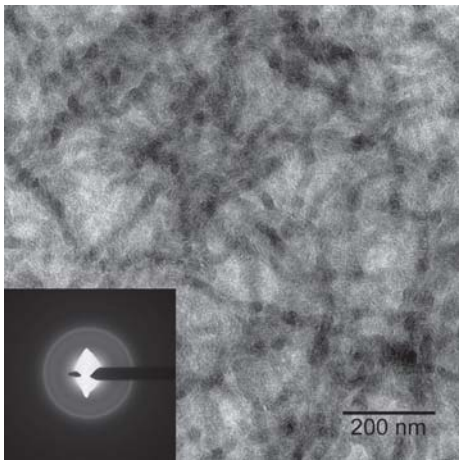
500nm sputtered copper film on a 10nm TaN/5nm α-Ta barrier layer (250W sputter bias condition)



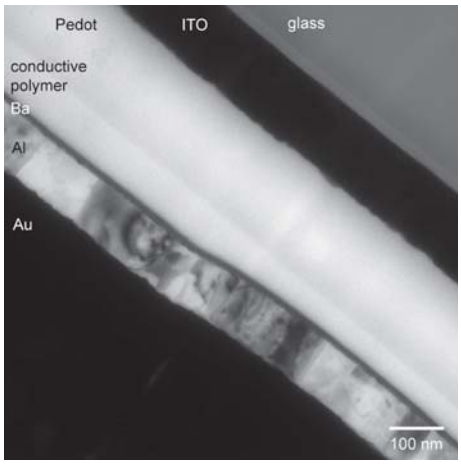
BF image of Si nanowire with indium catalyst



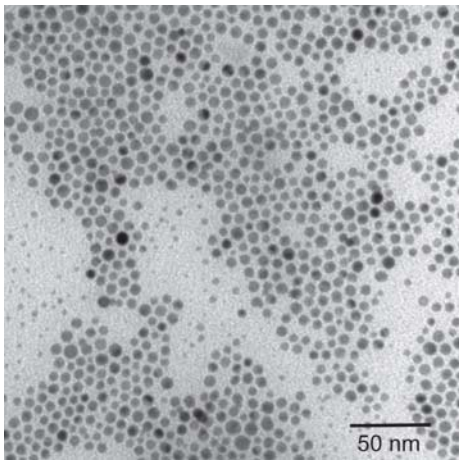
with nanoclay strengthened textile



Regioregular poly(alkylthiophene) fibres (P39T fibre pinane)



Build-up of polymer LED



Au nanoparticles stabilized with dodecylamine

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