



umicore

Cobalt & Specialty Materials

Analytical laboratory

4 areas of expertise

Chemical and physical analysis

Metallographic examination

Mechanical testing

Powder metallurgy

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CHEMICAL ANALYSIS

Titration of oxygen, nitrogen, carbon and sulphur in powder or solid	Instrumental Gaz Analyser (IGA)
Elemental analysis and impurities in a material	Sample preparation by acid leaching (including HF), alkaline fusion, sampling for solid parts, machining for solid parts, solvent extraction, thermal debinding. ICP-OES, AA and EDX spectrometry
Acid-base, redox and precipitation titration	Titrimetry
Organic binder content of a powder	SOXHLET extraction

PHYSICAL ANALYSIS

Determination of specific surface area and pore size distribution	BET/BJH techniques
True density	Helium pycnometer
Powder densities measurement (Apparent, Scott, Hall, Tap)	
Particle size distribution	Laser diffraction (wet/dry) or sieving
Fisher size measurement	Fisher Sub Sieve Sizer
Flowability measurement	Hall device
Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) under different atmospheres including hydrogen	Thermal analyser
Expansion coefficient, phase transformation temperatures, sintering rate measurements under different atmospheres including hydrogen	Thermo-mechanical analyser

METALLOGRAPHIC EXAMINATION

Metallographic preparation	Cutting-off, embedding, polishing down to 0.3 μm
Optical microscopy	Stereomicroscope : 1x to 50x Optical microscopes : 50x to 1500x
3D microscopy	Digital microscope with large depth of field ; magnification range 50x to 5000x ; 2D or 3D imaging ; profile measurement (accuracy <1 μm)
Electron microscopy	SEM (LaB6) coupled with EDX probe ; SE/BSE imaging

MECHANICAL TESTING

Hardness and micro hardness measurement	Hardness testers (Vickers, Brinell, Rockwell A/B); $\mu\text{Hardness}$ (0.02 - 30 N)
Tensile strength measurement	
3-point bending measurement	
Impact test	Charpy, unnotched (energy 300 J)
Adhesion of thin layers and coatings. Characterisation of wear modes and critical damage loads	Scratch test (Rockwell ; R=100 μm ; load 0.02 - 30 N)

POWDER METALLURGY

Powder blending	Plough and chopper mixers (10 to 120 L) under controlled atmosphere 3D blender (100 ml to 5 L)
Powder milling	Hammer mill Air or nitrogen spiral jet mills (10 g - 10 kg) Air or nitrogen jet mill with dynamic selector (5 kg - 50 kg) Horizontal vibration mill (8 L) Planetary mills (0.25 L) Ball mill (1 L - 10 L) Attritor mill (0.5 L - 5 L)
Cold pressing	Hydraulic press (50 t)
Hot pressing	Hot press (up to 1000 °C, 50 MPa)
Cemented carbide sintering	Graphite furnace (hydrogen, argon, partial pressure, vacuum) up to 1500 °C
Thermal treatment, sintering	Tube furnace under gas (pure hydrogen, nitrogen, argon) up to 1500 °C