DACUM Occupational Research Chart for Nanotechnology Technician

Occupation Description: Versatile, flexible nanotechnology technician must be able to provide support for developing nano product design; building, installing, and monitoring nanotechnology equipment and processes, problem solving, quality assurance, and preventive maintenance/repair of equipment. Roles may include technical support, engineering research, and/or testing/verification of a variety of products/processes for a wide range of industries. Must be able to thrive in a rather chaotic, cutting-edge scientific work environment.

Duties → **Tasks**

	Duties	Tasks								
A	**Characterize Nano-scale Materials**	**A1** Clarify customer requirements	**A2** Select appropriate analytical equipment	**A3** Verify GRR	**A4** Check SPC	**A5** Prepare sample	**A6** Collect data	**A7** Manage data	**A8** Analyze data	**A9** Investigate data anomalies	**A10** Report findings
B	**Execute Device Processes**	**B1** Clarify customer requirements	**B2** Identify process flow	**B3** Verify components	**B4** Deposit materials	**B5** Transfer pattern	**B6** Assemble components	**B7** Verify process results	**B8** Package device	**B9** Test and verify device	**B10** Characterize performance
C	**Build Nano-technology Systems**	**C1** Clarify customer requirements	**C2** Perform process planning	**C3** Collect parts from inventory	**C4** Review assembly drawings	**C5** Prepare parts	**C6** Build subsystems	**C7** Test and verify system components	**C8** Assemble system	**C9** Integrate control systems	**C10** Test/verify system interface	**C11** Characterize performance	**C12** Obtain Customer acceptance
D	**Perform or Assist With Product De-velopment**	**D1** Perform product research	**D2** Design prototypes	**D3** Evaluate prototypes	**D4** Revise product design						
E	**Maintain Equipment**	**E1** Outline PM program	**E2** Peform PMs	**E3** Test and verify (SPC)	**E4** Verify customer complaint	**E5** Perform trouble-shooting	**E6** Collect appropriate tools	**E7** Implement corrective action	**E8** Replace parts or components	**E9** Provide service report to customer	**E10** Maintain service records
F	**Control Environment**	**F1** Monitor temperature and humidity	**F2** Monitor vibration	**F3** Monitor particles and airborne contaminants	**F4** Measure electromagnetic discharge	**F5** Maintain specs on quality of source power	**F6** Enforce company P&Ps	**F7** Follow HAZMAT procedures			
G	**Maintain Personal Qualifications**	**G1** Identify your needs, gaps	**G2** Pursue additional training	**G3** Engage in cross-training and mentoring	**G4** Attend in-house training	**G5** Read trade and related literature					

Acronyms and Term Definitions

AFM – Atomic forces microscope
GD&T – Geometric dimensions and tolerances
GRR – Gauge repeatability and reproductability
HAZMAT – Hazardous materials handling and disposal
ISO – International Standards Organization
MEMS – Micro-electromechanical systems
MOEMS – Micro-opto-electromechanical systems
PM – Preventive maintenance
P&Ps – Policies and procedures
QC/QA – Quality control/assurance
SEM – Scanning electron microscope
SPC – Statistical process control
TEM – Transmission electron microscope

General Knowledge and Skills

Semiconductor manufacturing processes
Nanotechnology manufacturing processes
Electrical, chemical, and mechanical assembly processes
Mechanical precision to the nano scale
Volumetric measurement to the nano scale
High precision electrical measurements
Crystallography and metallurgy
Toughness, strength, and ductility of materials
Microscopy and spectroscopy
Basic chemistry and quantum physics
Familiarity with quantum effects
Use of measuring instruments, tools
Nano scale metrology
Unit conversion
Technical communication skills
Technical math, including algebra, geometry, and statistics
Vacuum systems
Gauge R&R
Reading mechanical drawings
Quality assurance (incl. statistical process control)
Implements continuous improvement techniques
Materials handling (including hazardous materials)
Safety awareness and practice
Understanding of industry reference materials
ISO 9000
Geometric dimensions and tolerances (GD&T)
Risk management
General computer skills
Business skills
Organizational skills
Problem solving skills
Project management skills
Interpersonal skills

Future Trends and Concerns

Rate of nanotechnology industry development
Explosion of knowledge, keeping pace
Public perception
Potential toxicity of materials at nano scale
Environmental health and safety concerns and regulations
Could be disruptive of future economy
Quantized (non-conventional behavior of matter
Technology migration out of the U.S., and decrease in industrial research in the U.S.
Broad based dilution of nano resources

Tools, Equipment, Materials and Supplies

TEM and SEM microscopes
Advanced optical microscopes
Scanning probe microscopes (AFM and others)
Semiconductor manufacturing equipment
Thin-film measurement equipment: profilometers and ellipsometers to the nano scale
Spectrophotometer
Laser interferometer
X-ray (fluorescence and diffraction)
Computer software (word processing, spread-sheet, database, presentation, email, etc.)
Reference handbooks
Lab equipment (materials testing, etc.)
Oscilloscope
Voltmeter
Microbalance
Frequency generator
Instrument interface software
Personal protective equipment
NOTE: "tools" in the context of nanotechnology research and manufacturing refers to complex analytical or processing equipment

Worker Attitudes, Traits and Behaviors

Willing to take on high-risk endeavors
Adaptable, open to change
Professional
Reliable
Gives, receives criticism well
Strives for continuous improvement
Analytical, detail oriented
Attention to craftsmanship
Demonstrates quality awareness
Logical
Self-motivated, independent worker
Team worker, mature
Thorough
Problem-solving skills
Persistent
Honest, shows integrity
Resourceful
Punctual

DACUM Research Chart for
Nanotechnology Technician

DACUM Panel

Alain Diebold
Sematech
Austin, TX

Anthony Jimenez
Molecular Imprints, Inc.
Austin, TX

John Randall
Zyvex Corporation
Richardson, TX

Peter Rhyins
Photronics
Allen, TX

George Skidmore
Zyvex Corporation
Richardson, TX

Kevin Vargason
Intelligent Epitaxy Technology
Richardson, TX

Ken Vickers
University of Arkansas
Fayetteville, AR

DACUM Facilitator

Michael Jones

Texas State Technical College Waco

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TSTC Waco
IDEAS Center
3801 Campus Drive
Waco, TX 76705
(254) 867-3300
(254) 867-3326 fax