EQUIPMENT AND LABORATORY FACILITIES AT CSM

1. Electron Microscopy
   - Electron Philips CM200 Scanning - Transmission Microscope with Energy-Dispersive Spectroscopy
   - Philips EM 400 Transmission Electron Microscope
   - JOEL JXA - 840 Scanning Electron Microscope with Energy-Dispersive Spectroscopy
   - Digital Instrument Atomic Force Microscope

2. Nuclear Magnetic Resonance
   - NMR - 400 Mhz Liquid - Solids NMR Spectrometer

3. Chemical and Structural Analytical Facilities
   - Optima 3000 ICP Spectrometer
   - Cray 5 U.C. Spectrophotometer
   - Leco Interstitial Analyzers
   - Complete Hydrogen (diffusible and total) Analyzer
   - Mossbauer Spectrometers
   - UV Spectrometers
   - Chromatographs
   - X-ray Diffraction Systems

4. Electronic Materials Characterization
   - JA Woolham Spectroscopic Ellipsometer
   - Three Wavelength Gaertner Ellipsometer
   - Tencor Temperature Dependent Hall Effect Analyzer
   - Low Temperature Photoluminescence Spectrometer
   - C-V, I-V, PV Efficiency Instruments
   - Near Field Scanning Optical Microscope
   - Varian Ion Implanter

5. Electronic Materials Processing Facility
   - 1000 sq. ft. Class 1000 Clean Room
   - 3000 sq. ft. Thin Film Deposition Facility

6. Physical Characterization
   - Netzsch Simultaneous Thermal Analyzer
   - Netzsch High Temperature Dilatometer
   - Netzsch Differential Scanning Calorimeter
   - Netzsch Thermal conductivity tester
   - Seiko TG/D and Cahn TGA Both Interfaced to a Fisons Mass Spectrometer
   - Bio-Rad Fourier Transform Infrared Spectrometer
   - Thermal Conductivity
7. Polymer Characterization
   Perkin-Elmer Differential Scanning Calorimeter
   Kayeness Capillary Rheometer
   Wyatt Technologies Laser Photometer
   Light Scattering Apparatus
   Rheometrics Dynamic Rheometer

8. Computational Resources
   IBM SP-Z 8-Node Parallel Supercomputer
   SGI Indiago 2 Workstation Clusters
   IBM RS-6000 Workstation Clusters
   Large Format Dye Sublimation Color Printer
   2 Color Laser Printers
   SGI 6 Processor Power Challenge
   1 Color Scanner

9. Commercial Codes
   Process Simulation Software - Aspen
   Finite Element Software - Abacus
   Quantum Mechanical Software
     - Gaussian 94 Spartan
   Materials and Molecular Modeling Packages - Cerius 2

10. Mechanical Testing and Forming
    4 MTS Computer-Controlled, Servo-Hydraulic Uniaxial Testing Units
    2 Instron Screwdriver Uniaxial Testing Units (one with high temp-control arm capability)
    4- and 3- Point Bend Fixture (ambient and high temp)
    MTS Nano Indenter XP
    Sheet Metal Testing Fixtures
    Fracture Toughness Fixtures
    Instrumented Impact Tester and Numerous Other Impact Testers
    Fatigue Testing: Revised Bending and Torsional Fatigue Testing Machines
    A Wiredrawing Bench
    Hot and Cold Rolling Mills
    Numerous Hardness Testers
    Thermal Technologies Hot Press System (ZST Capacity, Vacuum, 3300°F)

11. Coating/Thin Film Testing and Deposition System
    Scratch/adhesion Tester
    Wear Tester
    Profilometers
    8,000 Square Feet Thin Film Labs (2 clean rooms)
VAC TEC, VCC 7740 Vertical Cathode PVD Unit
VAC TEC, MLIV Horizontal Cathode PVD Unit
Varian Ion Implantation
Hyper Ion PVD Unit
Electron Beam & Thermal Evaporation Units
Perkin Elmer RF Sputtering System 2400-8SA
Closed Field Unbalanced Magnetron System
Watkins Johnson Atmospheric Pressure CVD Unit
Plasma Enhanced CVD Unit
Laser Surface Modification Facilities

12. Joining and Welding Laboratory
Complete Arc Welding Capability
Laser Welding System
Solid State Bonding
Soldering and Brazing Capability
Fixtures for Hot Cracking Susceptibility Testing
Gleeble Thermomechanical Simulator
Experimental Welding Consumable Production Capability
Underwater Welding

13. Mass Spectrometer
Extrel ELQ - 400 Triple Quadruple Mass Spectrometer
Extrel ELQ - 400 LC/MS Triple Quadruple Mass Spectrometer
Perkin Elmer Q-Mass 910 GC/MS Systems
JOEL M Station High Resolution Mass Spectrometer

14. Metallography and Optical Microscopy
Specimen Preparation Capability
Numerous Metallographic Systems and Microscopes
Image Analysis
Hardness testers
Numerous Heat Treatment (vacuum and air) Systems
Photographic Equipment

15. Corrosion and Surface Analysis
EG&G PARC 273 Potentiodynamic Analytical System
Salt Spray Corrosion Testing
High Temperature Corrosion Testing
PH and Selective Electrode Sensors
XPS
Auger Electron Analysis
SIMS
Schlumberger 1255 High Frequency Response Analyzer
3852 HP Data Acquisition System
Cyclic Voltammetry Measurement
Electrochemical Impedance Analyzer
Ellipsometer
Surface Area Analyzer

16. **Pyrochemical Capabilities**
   Molten Salt Electrorefining
   Molten Salt Electrowinning
   Molten Salt Heat Treatment Baths
   Smelting Capabilities
   High Temperature Melting Furnace
   Vacuum Industries Inductotherm Vacuum Furnace (2200°F)
   Seven Protective Atmosphere Boxes with nitrogen and moisture control

17. **Hydrometallurgical Capabilities**
   Leaching Systems
   Precipitation Systems
   Analytical Support
   Sol Gel Processing

18. **Particulate Processing and Analysis**
   Powder Metallurgy Processing
   Mineral Processing
   Ceramic Particulate Processing
   Particle Size Analyzer

19. **Nuclear Radiation Analysis**
   High Gamma Ray Detection with Simulation Detectors
   Resolution Gamma Ray Detection with Semiconductor Detector
   Charge Particle Detection with Semiconductor Defectors
   Neutron Activation