

APPENDIX C– LABORATORY EQUIPMENT

**Table C-1 Equipment available to the BS Metallurgical Engineering Program
Description**

Materials Processing

MTS ISTIR-10 3D Friction Stir Processing Equipment
MTS intelligent Laser Processing System (3 KW Nd: YAG laser, a Fanuc M16i Robot, and Two Feed Systems)
RIFTEC Refill Friction Stir Spot Welding System
Cold Spot, Refill Friction Stir Spot Welding System
Centerline, SST Cold Spray System
Direct Write Lab (includes Maskless Mesoscale Material Deposition, Dimatix Ink Jet and nScript technology)
Hughes, 40 kW Induction Heating System
High frequency Sonicator
Ameritherm Induction heating system
Custom Thermoplastic Friction Stir Equipment
Dual-Reed Ultrasonic Welder
Centerline Cold Spray Unit
Jetline Automated MIG Seam Welder
Lincoln Electric Power MIG Welder
Big Blue Trip Hammer
Gas Forge (2)
Coal Forge (2)
Blacksmithing Equipment (Tongs, Hammers, Anvils)
Metal Repose Equipment (Stakes, Hammers)
Vacuum Melting Furnace
Vacuum Oven
Lindberg Electric Furnaces (2)
Box Furnaces (2)
Assay Muffle Furnace
Horizontal Quartz Tube Inert Gas Furnace
Glass Slumping Kiln
Salt Pots (2)
Jaw Crusher
Crushing and Grinding Equipment (Roll Mill, Flour Mills)
Ball Mill Rolls (2)
Union/Szegvari Inc, Attrition Mill
Sizing and Sieving Equipment
Carver Hot Press
Portable Casting Equipment (custom)

Buehler Polishing and Grinding Wheels (2)

Buehler Abrasimet Cutoff Saw

LECO Polishing and Grinding Wheels (3)

Fenn 6" 1-High Rolling Mill

Shaking Table

Flotation Cell

Rare Earth Magnetic Separator

Filter Press

Hot Plate/Stirrers (2)

Ultrasonic Bath

Fume Hood (4)

Mechanical/Chemical Testing

MTS 70 kip Universal Testing Machine

MTS 810 110 kip Material Test System

MTS 810 55 kip Material Test System

MTS 858 5.5 kip Material Test System

MTS 20 Kip Material Test System

MTS 50 lb Force Transducer/Load Cell

MTS 1" Extensometer

MTS Tytron 250 Micro Mechanical Tester

RPM NJ1630 Mechanical Wear Testing

Alternate Immersion Corrosion Test Cell

TA Instruments, Q800 DMA

LECO, Interstitial Analyzer

LECO CS-600, Carbon/Sulfur Determinator

LECO TCH-600, Oxygen/Hydrogen/Nitrogen Determinator

Cryogenic Tensile Test Facility-20 kip attachment

Dynamic Projectile Impact Tester, 200 fps

Upgraded software EG&G PARC model 273A Potentiostat/Galvanostat

Instron Instrumented Izod Impact Tester

Instron Instrumented Charpy Impact Tester

Buehler Micromet 4 Microhardness Tester

Rockwell Hardness Tester (2)

Brinell Hardness Tester

Buehler Metallographic Polisher/Grinder (2)

LECO Vibratory Polisher

LECO Mounting Presses (2)

LECO Polisher/Grinder (3)

Mettler Toledo pH meter

Analysis/Measurement

Zeiss Supra 40 VP Field Emission SEM

Hitachi H-7000 FA TEM

Atomic Force Microscope

Nicom 780 Surface Charge and Particle Size Analyzer

Phillips Macroscopic Image Analysis System

Rigaku Ultima Plus X-ray Diffraction System
Biorad FT-IR Spectrometer
TA Instruments Differential Scanning Calorimeter
TA Instruments Thermomechanical Analyzer
Nikon Metallographic Microscope with Buehler Omnimet Image Analyzer
Olympus Microscope with LECO IA32 Imaging software
Microtrac Laser Particle Size Analyzer
16-channel Data Acquisition Center
Omega Bridge Completion/Strain Gage Unit (2)
Rane-Hart Contact Angle Goniometer
Corrosion Measurement Equipment
Wilhelmy Plate Tensiometer
Bohlen Rheometer
Brookfield Viscometer
Omega Optical Pyrometer
Oxygen Bomb Calorimeter
Precision Balances (2)
Balances (2)
Metallographic Sample Catalog

Research Databases/Software

SolidWorks
MathCad
LabView
DICTRA
THERMOCALC
Virtual Welding system