Electronics

Client
Clemson University

Location
Anderson, SC, USA

"An unexpected consequence of the building is that numerous groups have requested the use of its common areas for various functions... It is a testimony to its architects and engineers"

- Christian E.G. Przirembel
Clemson University

Nanotechnology for the Advanced Material Research Lab

Project Highlights

- Nanotechnology Microsopy Suite
- Class 10 Cleanroom
- LEED™ Silver Certification
- Research Laboratories
- Conference Areas

Project Description

Clemson University's Advanced Materials Research Laboratory (AMRL) consolidates nanotechnology, electronic instrument device and laser labs, chemistry labs, and cleanroom space to be used for educational activities and industry research. The design concept was provided by Clemson. CH2M HILL IDC led the full design and construction services team of engineers and lab consultants in creating flexible, cutting-edge academic research space. This cornerstone building is a critical initiative for Clemson to promote advanced materials research grants, including the attraction of world-class researchers (endowed chairs). Supporting these endeavors are research, faculty and student offices, meeting rooms, and a two-story central lobby, created as a gathering space for the sharing and exchange of ideas. Sustainability, LEED™ Silver Certification and high-performance building appraisal are all key components of the facility.

CH2M HILL IDC provided include architecture and engineering, stakeholder representation, and construction administration for a state-of-the-art facility located in the University's Clemson Research Park. Design issues included flexible laboratory space and electron microscopic area sensitivities, with isolated independent slabs, acoustic dampening, electronic shielding, vibration analysis, air distribution systems with (66) lab-hoods, cleanroom space, and specialty labs for laser, instrument and draw-tower (fiber-optics) research.

This research facility is intended to attract researchers and industry leaders in order to meet the university's goal of becoming one of the top-twenty public universities in engineering. To achieve this goal, considerable emphasis was placed on aesthetic values and the use of quality contruction material. Technical design considerations emphasized control of vibration, EMI, noise and air currents to support highly sophisticated equipment research activities, while building sustainability and flexibility into the design.

Vibration and Noise Challenges: The lab is intended to house Transmission Electron Microscope (TEM), Focused Ion Beam (FIB) Instrument, X-Ray Photo Spectrometer (XPS or ESCA), Transmission Electron Microscope (TEM), High Resolution Transmission Electron Microscope/Scanning Transmission Electron Microscope (HRTEM/STEM

"One thing that truly impressed me about IDC's performance was the ability to obtain one stop shopping in terms of the engineering and technical design... IDC is one of the few companies that we know capable of providing this degree of integration."

- Joseph W. Kolis
Clemson University

with resolution of 0.5 to 1 nanometer), and Scanning Electron Microscope (SEM). NIST vibration levels were reviewed but not required. To provide the vibration criteria goal of 250 micro-inches/second, the design included 12 isolated inertia floor slabs. Each slab is isolated from the wall, and rooms were isolated from one another as well as the adjacent corridor. To provide noise isolation, the walls around each of these labs were packed with fiberglass insulation using two layers of gypsum board on each side to establish a wall sound rating of STC 56.

Air distribution diffusers were evaluated and determined to be a potential problem in the microscope and wet labs, as electron microscopes are sensitive not only to physical vibration through the building structure, but to air currents as well. Air velocity in front of fume hoods required control, to prevent disruption to the flow of air entering the hoods. CH2M HILL IDC addressed these issues through the use of special radial supply diffusers (Krueger Model TAD), selected to handle the large volumes of air and displace the airflow in the lab at a low velocity, thereby eliminating any air currents and velocity vibration.

Flexibility: A major focus of the project was to design flexibility into the mechanical systems. A unique feature was a manifold exhaust system with future ports for connecting additional hoods, that also reduced the number of stacks required.

EMI Challenges: Faraday cages were incorporated into the design to mitigate EMI from the labs. Transformers and major electrical equipment were placed on the opposite ends of the building from the beam-based microscope labs based on extensive empirical data and models prepared by CH2M HILL IDC. Active cancellation systems were deferred for future installation if required. Incandescent lighting instead of fluorescent lighting was provided in the beam-based microscope rooms to mitigate lamp ballast EMI.

LEED™: The AMRL is scheduled to be Clemson's first LEED™ certified building and has been awarded Silver LEED™ certification.

Primary discipline leads on the team were LEED™ Accredited Professionals.