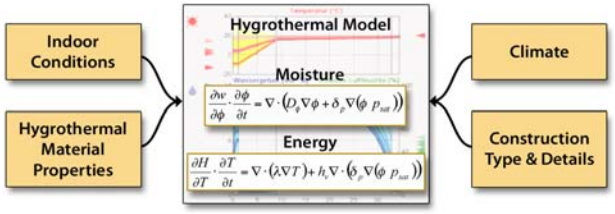
Exterior Insulation Finish System (EIFS) Walls

ORNL provides the tools to enable industry to engineer durable, moisture-tolerant EIFS wall systems.

EIFS's are among the most cost-effective building technologies for improving the insulating value of walls and the energy efficiency of buildings. The EIFS concept came to America from Europe in the 1970s and did well for several decades. However, problematic codes prescriptions for vapor control without recognition of their ramifications for humid climates, along with window and joint water leakage unrelated to the EIFS walls, created a misperception that some EIFS walls were causing moisture-related envelope failures. A collaborative effort by ORNL and the EIFS Industry Members Association (EIMA) is now enabling the industry to design superior next-generation EIFS wall systems using state-of-the-art moisture engineering technology.

The three pillars of envelope research are advanced hygrothermal modeling, materials and system characterization, and field testing.



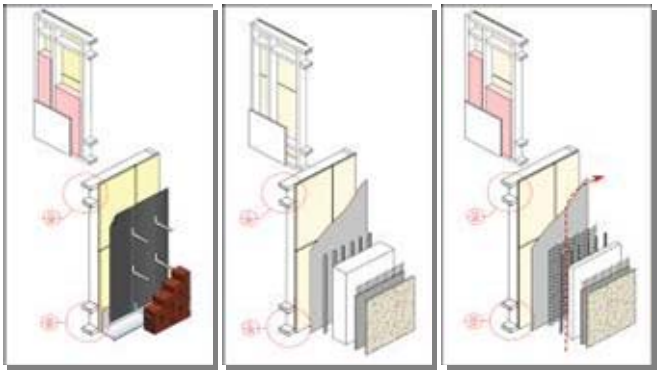
ORNL's Building Envelopes Group, in the Engineering Science and Technology Division, is contributing its expertise in materials and systems characterization, advanced hygrothermal modeling, and field research. EIMA brings decades of practical experience to the effort and has built a new natural exposure test (NET) facility for field-testing wall systems in Charleston, South Carolina — in the mixed-humid climate most challenging for EIFS. EIMS also underwrote the cost of constructing numerous test walls, which have been field-tested in NET facilities at ORNL (mixed-humid climate).

ORNL's hygrothermal properties laboratories for building materials.

In 2005 the Charleston facility was used to test conventional walls alongside various EIFS walls that the industry had on the market. In FY06, the effect of initial construction drying was investigated and reported. The experimental data have been collected and used to validate the EIFS performance data and to rank the performance of the tested configurations. Based on the results, a series of wall systems were constructed, instrumented, and installed in 2006.

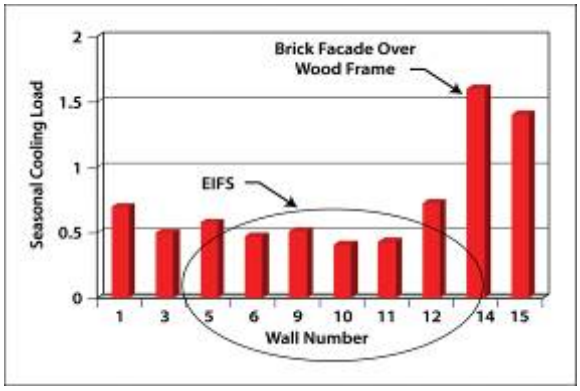
The EIFS Industry Members Association underwrote the cost of a natural exposure test facility in Charleston that can test 15 different wall systems side by side.

In FY08, advanced hygrothermal modeling will be used to analyze the results from 2006 and 2007. This entails analyzing the exterior environmental loads and the corresponding hygrothermal response for each wall system. The data will be used to validate the advanced hygrothermal models, which will be used to predict the performance of the walls when subjected to varying exterior loads, especially wind-driven rain.

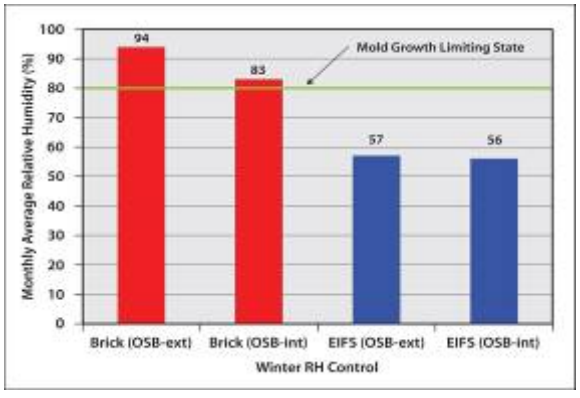


A conventional wall composed of brick façade on wood frame was tested alongside various EIFS walls. The drawings in the middle and on the right above are EIFS designs that have proven superior in both moisture control and insulating value.

EIFS's are inherently superior on thermal performance because the insulation is applied around the outside of the framing, avoiding thermal short-circuiting by the studs, but the project found EIFS designs that were superior to conventional walls on moisture tolerance as well. These EIFS walls are essentially "self-drying," with a layer that enables any condensation to drip out and also a space allowing buoyancy-driven convection.



Reducing cooling load saves energy.



Controlling humidity at the oriented strand board (OSB) sheathing is key to controlling mold.

The plots at left show the superior thermal and moisture performance compared to the conventional brick veneer wood frame wall.

Also in FY08, a joint research activity involving a Building America team (Building Sciences Corporation), several EIMA members, and ORNL will demonstrate the whole-building performance of EIFS wall systems selected as the best performers. This team will work closely with production builders to construct prototype homes with next-generation EIFS wall systems. These homes will be instrumented with state-of-the-art systems to monitor the thermal and moisture performance of the building envelope components. These prototypes will demonstrate durable, moisture-tolerant, highly energy efficient EIFS wall systems in new stick-built residential and commercial buildings.

The best EIFS performers will be built into prototype home to demonstrate their whole-building performance.

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