



Insulating With Magnesium Oxide

The Journey of Developing
an Aerated Insulating Magnesium Product

Green Building Technologies



Green Building Technologies

MISSION

- Lead industry in implementing green-building technologies
- Provide training in green-building technologies
- Enhance the commercialization of green technologies in the Canadian construction industry

Green Building Technologies

RESEARCH THEMES

- Net Zero Energy/Zero Carbon Buildings
- Building Integrated Renewable Energy
- Architectural Ecology
- Smart Building Management
- Material and Advanced Component Assemblies
- Education and Industry Transformation

Research Theme: Material and Advanced Component Assemblies



Develop high performance green products and materials

A BETTER WAY TO BUILD.



MgO

SYSTEMS

**FASTER.
STRONGER.
SAFER.™**

MGOSYSTEMS.COM



MgO Systems: Origin

Founded in 2010 by Todd and Vanessa McKay, MgO Systems was born after the McKay family home was struck by fire. The McKay family was unharmed but a lifetime of memories was destroyed in a matter of minutes.

Relying on their decades of experience in the construction and medical industries they set out to assemble a diverse team focused on the development of higher performance, technologically advanced and safer building solutions.



MgO Systems Ltd. develops and manufactures technologically advanced building solutions for commercial, residential, education, hospitality and healthcare construction. Our proprietary building technologies provide our clients with a superior fire rating, water resistance, insulation value and acoustic performance all with a pre-fabricated solution that is cost effective.

C3 Engineered Wall System™



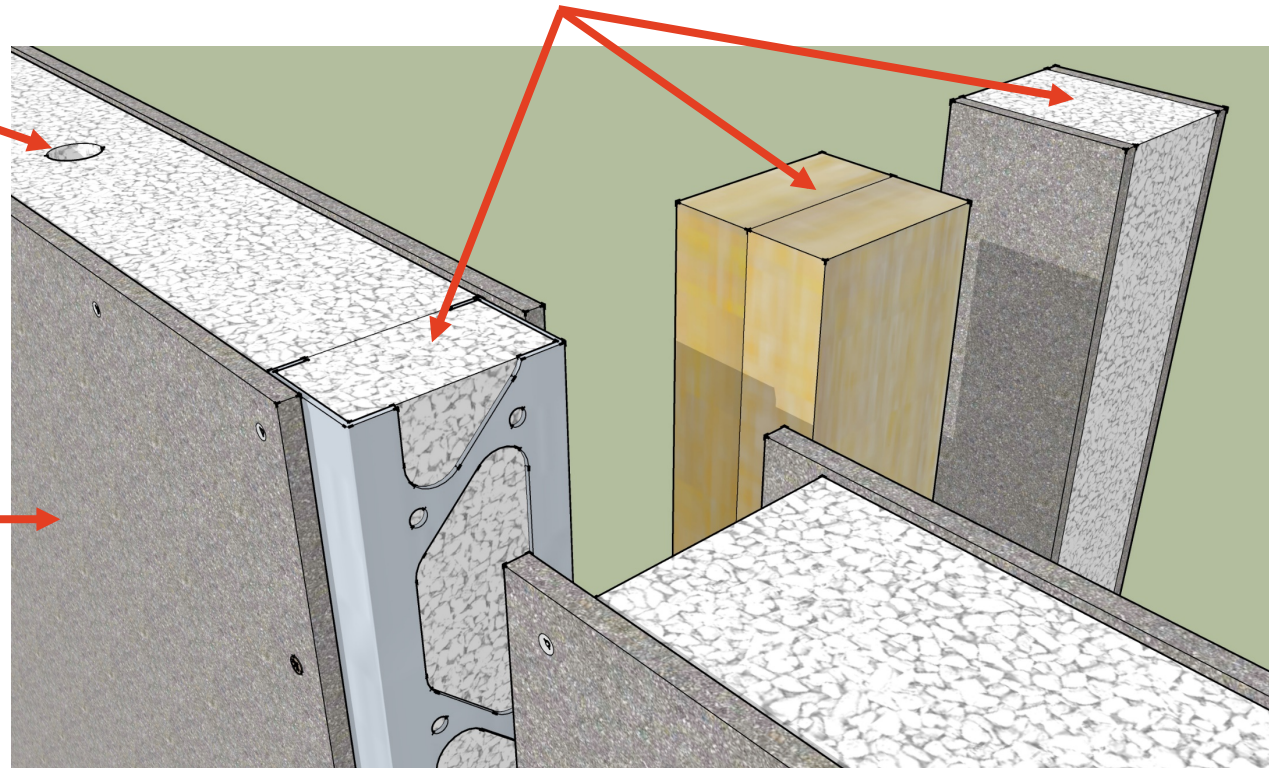
Structurally engineered
prefabricated wall panels
incorporating our proprietary C3
Fireboard magnesium oxide board

C3 Engineered Wall System™

EPS (Expanded Polystyrene) Core Provides R25 Rating and Superior Sound Dampening

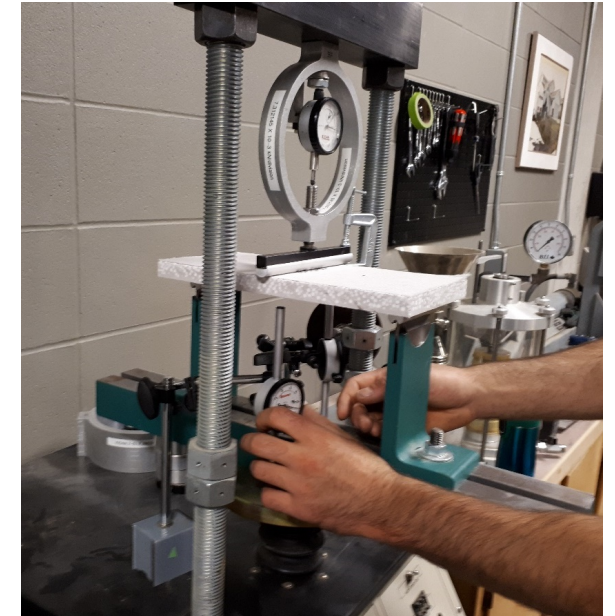
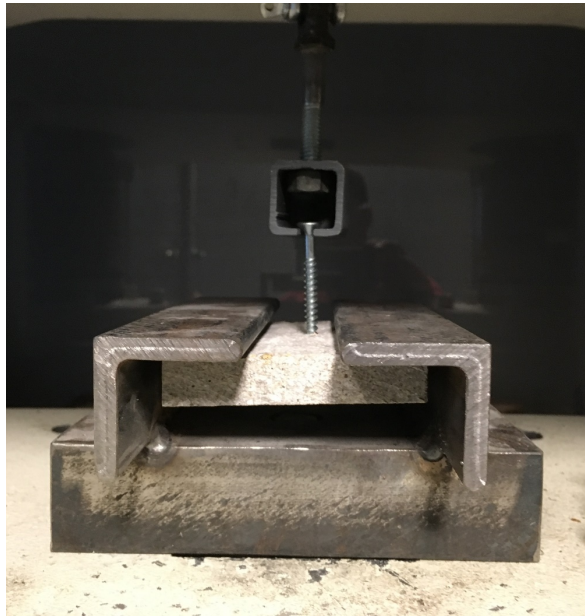
12mm Structural Magnesium Oxide Outer Boards (C3 Fireboard™) Deliver Superior Durability and Fire-Resistance

Lightweight Steel, Wood or SIP Block Framing = strong/quick connections & engineered support



C3 Fireboard™

Proprietary magnesium oxide board developed by MgO Systems and SAIT GBT with support from Alberta Agriculture.



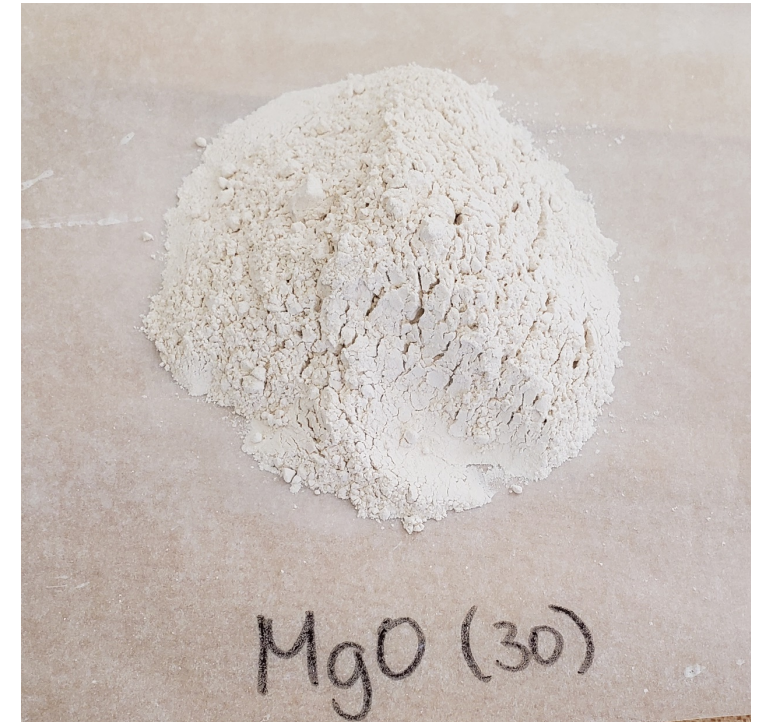
Why Magnesium Oxide (MgO)?

Magnesium

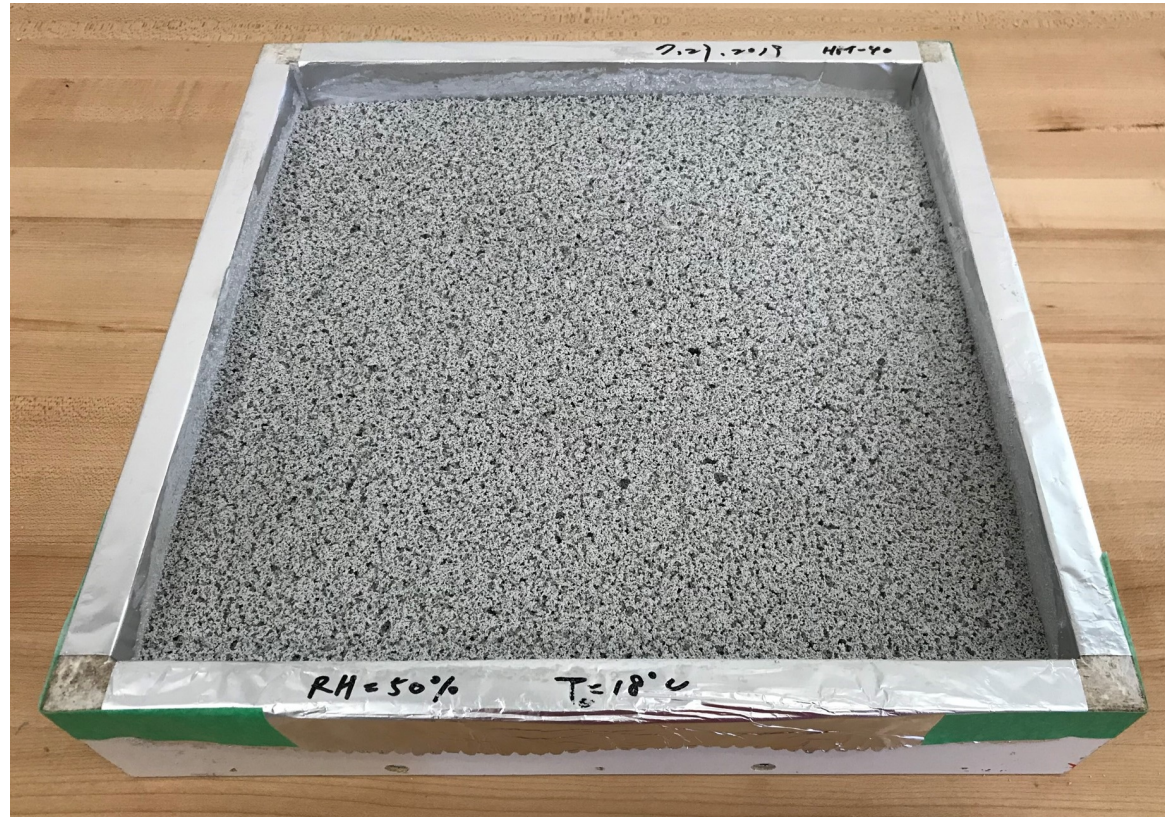
- 4th most abundant element on Earth (13% of the mass of the Earth)
- 3rd most abundant in seawater after sodium and chloride
- Occurs only naturally in combination with other elements
- Combined in alloys for its lightness and high strength

Why Magnesium Oxide (MgO)?

- MgO used in magnesia cement in place of Portland Cement (Largely CaO)
- MgO processed at $>600^{\circ}\text{C}$.
- CaO processed at $>1450^{\circ}\text{C}$
- Much less energy required to process MgO



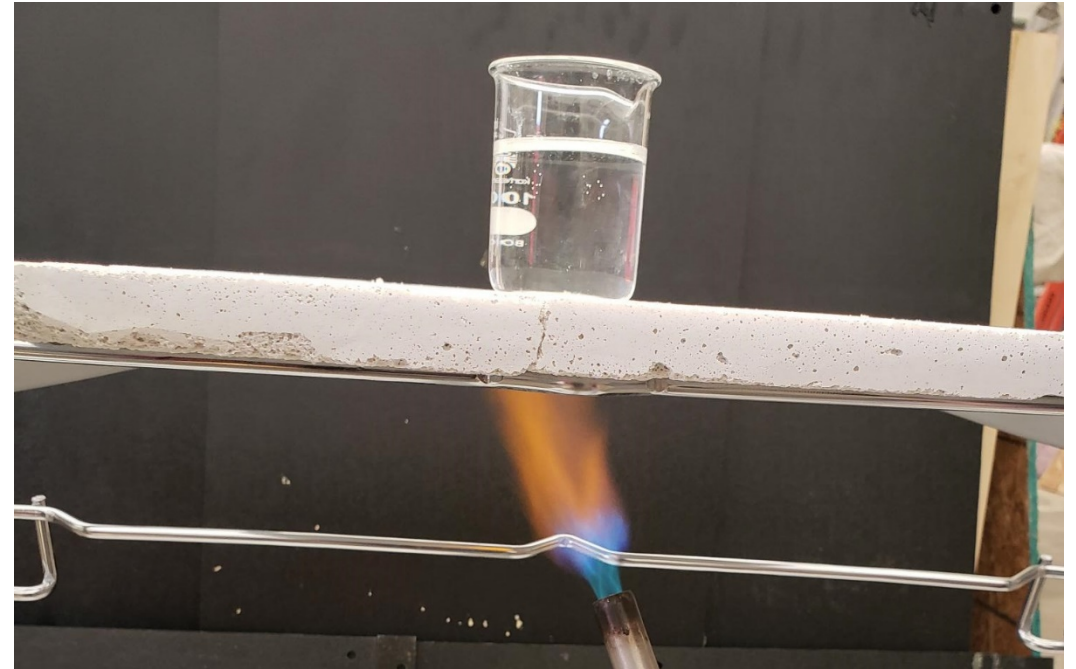
Why MgO Foam?



Why MgO Foam?

Advantages:

- Sound Reduction
- Fire Resistance
- Mold Resistance
- Lower Embodied Energy
- Carbon Sequestering
- Green
 - Natural
 - No Harmful Chemicals
- Readily Available



Why MgO Foam?

Disadvantages:

- Vapour Permeable
- Weight
- Low Integral Strength
 - Must be foamed in place or factory assembled into larger assemblies
 - Precast into assemblies
 - Can't transport bare

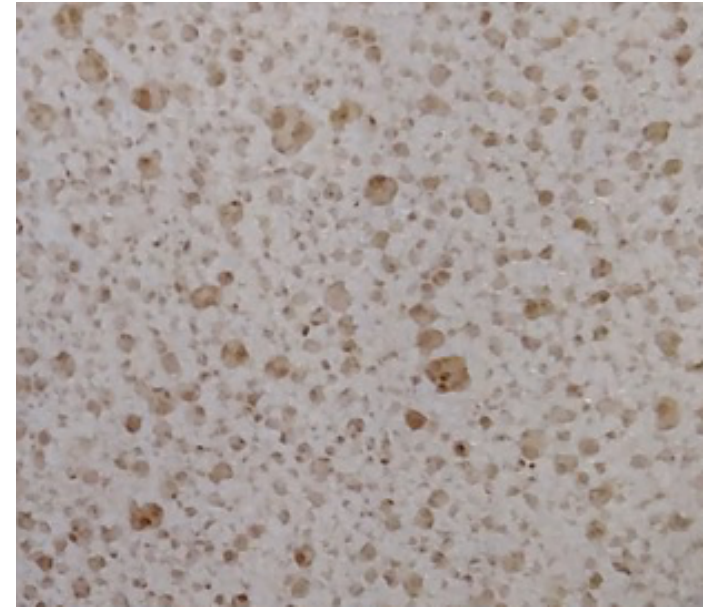
Firefoam™ Target Properties

Primary Objectives:

- Thermal Performance $> R \text{ 3/Inch } (0.53 \text{ (m}^2\cdot\text{K)/W})$
- Density $< 12 \text{ lb/ft}^3 (192 \text{ Kg/m}^3)$
- Moderate Integral Strength

Secondary Objectives:

- Water resistant
- Fire Rating



Firefoam™ Target Markets

Target Markets:

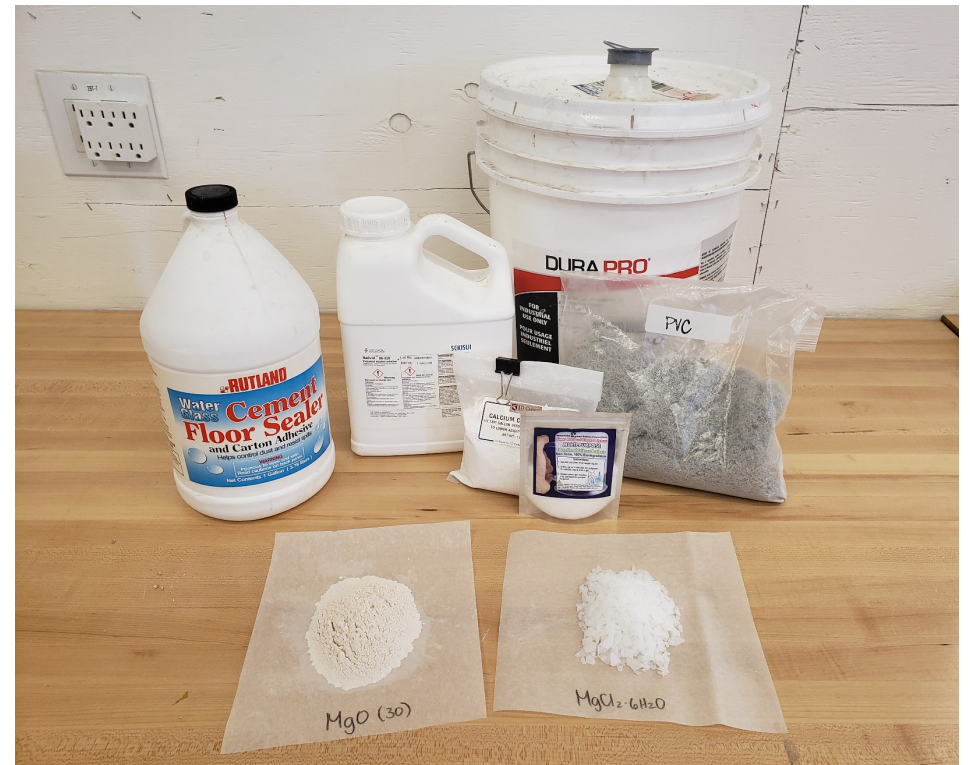
- Tilt-Up Panel Construction
- Non-Combustible/Fire Rated Assemblies
- MgO Systems C3 Prefabricated Wall Panels (Replace EPS core with Firefoam)



Developing Firefoam™

Determining Ingredients:

- Maintaining Low Ingredient Cost
- Maintaining desired foam structure
- Determining proper mixing order/timing
- Obtaining desired physical properties



Developing Firefoam™

Refining curing times and process:

- Strength strongly influenced by amount of time foam cures at different temperature and humidity levels



Developing Firefoam™

Mechanical Foaming

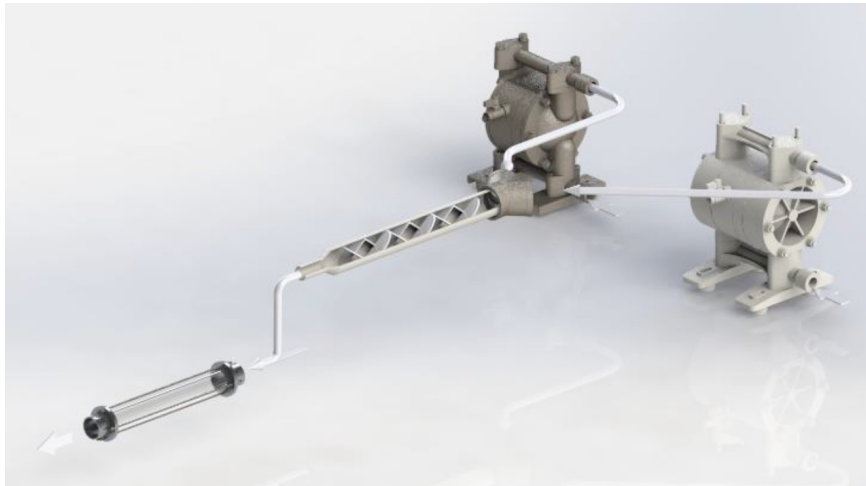
- Use of whisk to combine ingredients in a mixing container
- Difficult to be consistent
- Time intensive



Developing Firefoam™

Foaming Apparatus

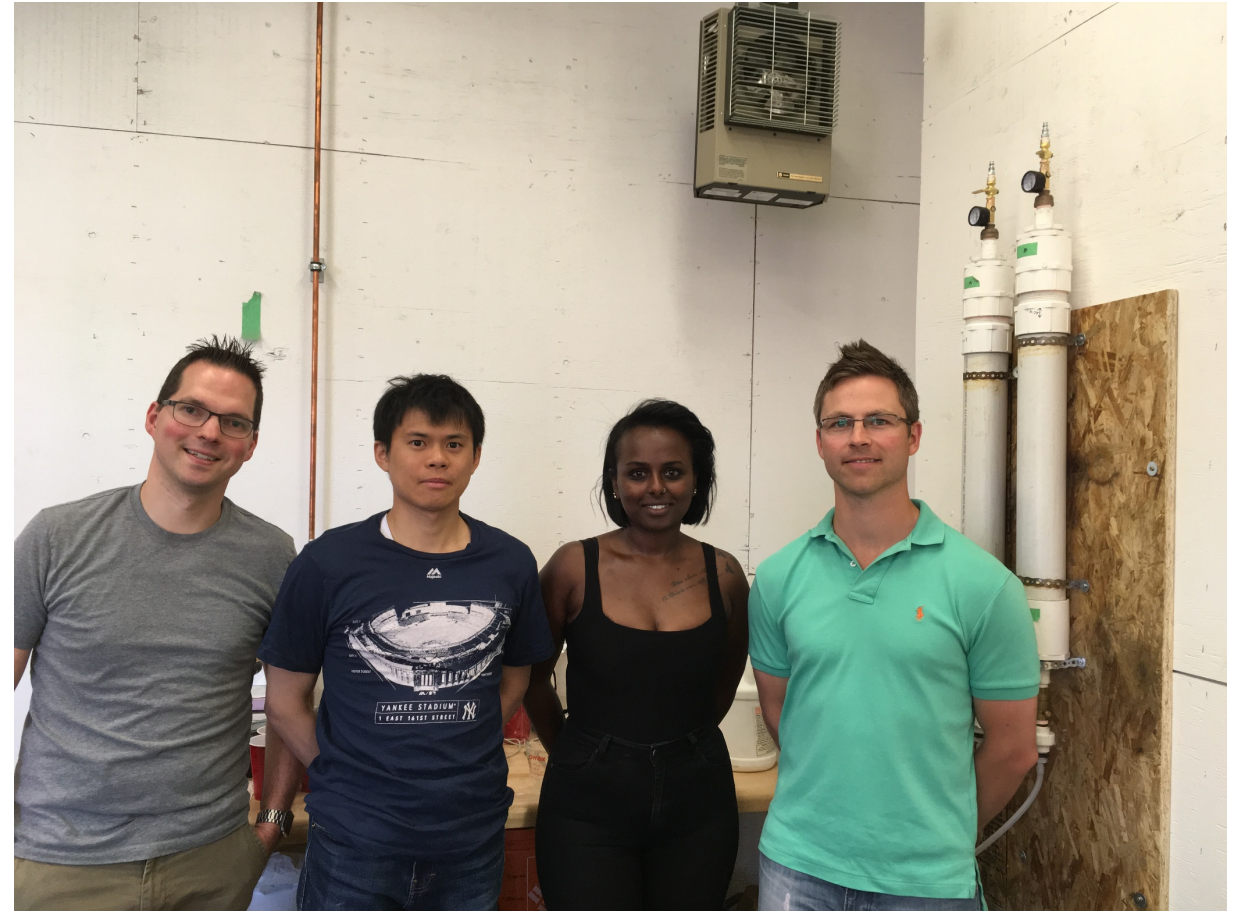
- Minimal documentation available of similar systems.
- Consistent foaming
- Consistent mixing of components



It Takes a Village....

Several Areas of Expertise Required

- Chemistry
- Building Science
- Material Testing
- Mechanical Engineering





Thank You!

SAIT.CA/APPLIED-RESEARCH

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