AN INTRODUCTION TO WHY BREATHABLE WALL SYSTEMS
Continuing Education Units 1 Hour
Moderator

Brett Little
Executive Director
GreenHome Institute
EMPOWERING
PEOPLE

To make healthier and more sustainable choices in the renovation and construction of the places we live

Over 20,000 educated
Nearly 8,000 certified homes
501 C3 Non Profit
Greenhomeinstitute.org
A new perspective on Ancient Building Materials of the Past, and their relevance to the Sustainable Future.
In your Ideal, Sustainable world, what would you expect from your building materials?

- Extreme Durability and Longevity?
- Resource Use and Manufacturing?
- Health and Safety?
- Environmental Impact?

Let us introduce you to the abundant natural resource; Magnesium Oxide. The amazing mineral that can achieve all of these requirements and much, much more!
Chapter 1: The History of MgO.

- The Terracotta Army of China
- The Great Wall of China
- The Pantheon, Rome
- The “Official” discovery of MgO
- Current Uses
Qin Shi Huangdi’s Terracotta Army has large amounts of MgO. Modern Archeologists claim there is not a definitive process that they have found to how they made these so long ago. They come up with many clever ideas to how they could have “fired” these life size, partially solid ceramic figures, when the building industry in China is making kiln free ceramics now. Magnesium Oxide Sheeting!
The "Great White Mountains" that "The Wall" follows, are said to contain enough MgO to replace all of the Drywall and Plywood, on the planet, at the current consumption rate, for 800 years.

MgO based mortar, and soil brick stabilizer, is used extensively on The Wall, and in many places, has outperformed, and outlived even some stone.
The “pozzolana” they used for the cement in many Roman buildings contain large amounts of MgO and other Metal Oxides. A main source for raw material was, of course; Magnesia, Rome. There the volcanoes had been “cooking it down” for them, much the same as we do in kilns today.
In 1618 a farmer at Epsom in England attempted to give his cows water from a well. This they refused to drink because of the water's bitter taste. However the farmer noticed that the water seemed to heal scratches and rashes. The fame of Epsom salts spread. Eventually they were recognized to be magnesium sulphate, MgSO₄. Black recognized magnesium as an element in 1755. It was isolated by Davy in 1808 who electrolyzed a mixture of magnesia (magnesium oxide, MgO) and mercuric oxide (HgO). Davy's first suggestion for a name was magnum but the name magnesium is now used.
The base of the Brooklyn Bridge is made from a locally mined cement called, “Rosendale Natural Cement”, that is CaO and a little MgO. The only natural, non-fired cement, made in the USA.

Terrazzo Floors of the 18th and 19th century are MgO based cements with decorative aggregate, ground and polished.
Taipei 101, Currently the tallest building in the world. All 101 stories use our exact brand of MgO sheeting on the inside and outside of all the walls, fireproofing beams and as the subfloor sheathing.
MgO Sheeting is the “official” specified construction material of the 2008 World Olympics buildings. A project costing over 160 billion dollars. Over 8 million square feet of MgO Sheeting is installed. It is now estimated that over 2,000 companies are manufacturing MgO Sheeting worldwide.
Chapter 2: The “Chemical” Properties

- Raw Resource
- Process
- MgO “Science”
- Concrete “Rainforests”
- Bionic Bonding

Periclase
The Natural Pure Crystal Form of MgO
Magnesium is the eighth most abundant element and constitutes about 2% of the Earth's crust, and it is the third most plentiful element dissolved in seawater. Although magnesium is found in over 60 minerals, only dolomite, magnesite, brucite, carnallite, and olivine are of commercial importance. Large mineral deposits of magnesite are located in Austria, Brazil, Canada, China, the Commonwealth of Independent States (CIS), former Czechoslovakia, Greece, Turkey, North Korea, former Yugoslavia, and the U.S.
Domestic Production and Use: Seawater and natural brines accounted for about 52% of U.S. magnesium compounds production in 2006. Magnesium oxide and other compounds were recovered from seawater by three companies in California, Delaware, and Florida; from well brines by two companies in Michigan; and from lake brines by two companies in Utah. Magnesite was mined by one company in Nevada, brucite was mined by one company in Nevada and one company in Texas, and olivine was mined by two companies in North Carolina and Washington. About 60% of the magnesium compounds consumed in the United States was used for refractories. The remaining 40% was used in agricultural, chemical, construction, environmental, and industrial applications.

### World Mine Production, Reserves, and Reserve Base:

<table>
<thead>
<tr>
<th></th>
<th>Magnesite production</th>
<th>Magnesite reserves and reserve base</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2006</td>
</tr>
<tr>
<td>United States</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Australia</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Austria</td>
<td>202</td>
<td>200</td>
</tr>
<tr>
<td>Brazil</td>
<td>107</td>
<td>166</td>
</tr>
<tr>
<td>China</td>
<td>1,350</td>
<td>1,400</td>
</tr>
<tr>
<td>Greece</td>
<td>144</td>
<td>145</td>
</tr>
<tr>
<td>India</td>
<td>104</td>
<td>105</td>
</tr>
<tr>
<td>Korea, North</td>
<td>346</td>
<td>350</td>
</tr>
<tr>
<td>Russia</td>
<td>317</td>
<td>330</td>
</tr>
<tr>
<td>Slovakia</td>
<td>288</td>
<td>130</td>
</tr>
<tr>
<td>Spain</td>
<td>151</td>
<td>150</td>
</tr>
<tr>
<td>Turkey</td>
<td>980</td>
<td>850</td>
</tr>
<tr>
<td>Other countries</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>World total (rounded)</td>
<td>4,210</td>
<td>4,050</td>
</tr>
</tbody>
</table>

In addition to magnesite, there are vast reserves of well and lake brines and seawater from which magnesium compounds can be recovered.

**World Resources:** Resources from which magnesium compounds can be recovered range from large to virtually unlimited and are globally widespread. Identified world resources of magnesite total 12 billion tons, and of brucite, several million tons. Resources of dolomite, forsterite, magnesium-bearing evaporite minerals, and magnesia-bearing brines are estimated to constitute a resource in billions of tons. Magnesium hydroxide can be recovered from seawater.
MgO “Science”

The Four Industrial Grades of MgO: dead-burned, fused, caustic-calcined and natural “un-fired”

And some snap shots of its chemical formation, in 3D effect.
The greater the charge, the greater the attraction, the greater the binding. Noble gas structures are formed, and the magnesium oxide is held together by very strong attractions between the ions. The ionic bonding is strong because you have 2+ ions attracting 2- ions.

The stable nature of Magnesium Oxide.
The “science” of the magical substance.
How it is fire-proof, mold-proof, water-proof, and why it is such an amazing binder.

IONIC (ELECTROVALENT) BONDING
At its 2007 conference in Paris the Intergovernmental Panel on Climate Change (IPCC) released a report confirming what everyone already knew – that people are to blame for global warming. Of the total estimate for carbon dioxide emissions from industrial processes in 2006, over 60 percent is attributed to cement manufacture. Which translate to about 12% of the total CO₂ emissions worldwide. When a mineral calcium carbonate (CaCO₃) is heated (calcined) in a kiln to at least above 825°C, (1517°F), even up to 1500°C, (2800°F), it is converted to lime (CaO) and carbon dioxide (CO₂). The lime is combined with other materials to produce clinker (an intermediate product from which cement is made), and the carbon dioxide is released to the atmosphere.

In 2006, the United States produced an estimated 101 million tons of cement,* resulting in the direct release of 50.5 million tons of CO₂ into the atmosphere. This calculation is independent of the gases released by the combustion of fuels consumed in making cement, which can equal the amount produced by calcining. Concrete is the principal building material in regions where wood is unavailable. Therefore, production of cement worldwide totaled 2.5 billion tons in 2006, and it is expected to increase.
Much like CaO, MgO starts out locked away in the earth with carbon dioxide (CO₂) but much less, (MgCO₂). And is cooked out at nearly four times less (400-800°F) than the temperatures needed to extract CaO.

The real impact comes when the “cements” are mixed together. When portland cement is mixed, about 33% of the CO₂ that is released in the kilns, is sequestered back into its “micro-crystal” formation during the curing period, that lasts upwards of 100 years. When MgO Ceramic Cements are mixed, close to 200% of the CO₂ that was released in the kilns is sequestered, during the curing period, lasting only 180 days. And even more is possible with the introduction of bio-mass (the best being Hemp), creating more minerals and space to “petrify”, sequestering even more CO₂!

Giving you the possibility of a true:

“Concrete RainForest”
Concrete “Rainforests”

Eco-Cement – No Capture during Manufacture

- CO₂
- MgCO₃·3H₂O
- Mg(OH)₂
- H₂O

Carbon neutral except for carbon from process emissions

Use of non fossil fuels => Low or no process emissions

Eco-Cement – With Capture during Manufacture

- CO₂ capture (Greensols process etc)
- MgCO₃·3H₂O
- Mg(OH)₂
- H₂O

Net sequestration less carbon from process emissions
Current CO2 output from Calcium Oxide based Cements

Net Emissions (Sequestration) per kg Cement

Net Emissions (Sequestration) per kg Cement

Portland Cement
Magnesia
Line
RecCement
EcoCement
LimeMortar
EnviroCement
During the last week in March 2007, research scientists and engineers from ten nations met in Barga, Italy to explore alternative technologies for stabilization and containment of radioactive materials. Despite the fact that the U.S. government has poured billions of dollars into vitrification programs – none of which are fully operational – this conference demonstrated growing scientific interest in more practical and economical technologies.

Many of the presentations given over the tightly scheduled four-day conference explored ceramic wasteforms and containment systems. Six presenters addressed ceramic cement technology now being developed by CeraLith in partnership with Argonne National Laboratory and researchers at the Russian Federal Nuclear Center (VNIIEF) and Mayak. These stimulated considerable interest among scientists focused on the processing and disposal of radioactive waste materials.

Ceramic cement is the only proposed solution that offers an ambient temperature process providing micro- as well as macro-encapsulation of contaminants in a durable and non-leachable phosphate form. In addition to immobilization and encapsulation of wastes, ceramic cement can also provide a high-strength structural material that performs well in high-temperature, radioactive environments.
This patent covers the bio-adhesive inorganic compound crafted by Mr. Tom Lally, and two subsequent patents have been filed. The Company is now preparing for full FDA testing as a new product line, potentially to be labeled BoneAdhesive to differentiate it from the conventional product lines of bone fillers or bone cements. It’s strategy is to pursue 510 (k) approvals as a filler, then 510 (k) as a cement, a 510 (k) as an anchor, and 510 (k) as a dental cement. Boston Biomedical, LLC is the company’s regulatory/testing consultant. The chemical composition is primarily MKP-Mono-potassium Phospate, MGO-Magnesium Oxide, and TCP -Tri-calcium Phosphate. Simply mixing with water, with no special mixing apparatus required, and the mixture has a set time is basically 10-15 minutes, which can be varied according to need. In a surgical setting, the physician can shape the precise bio-adhesive needed, or inject it into the patient. The mix can be paste-like for injection use, or can be putty like for shaped sizing. In testing, the adhesive qualities have been proven to attach ligaments and tendons to bone using the BSI solution. The Solution is bio-absorbable, non-toxic, and given its adhesive characteristics, can be a substitute for or augment the screws and other fasteners often used in knee, leg and shoulder surgery, and polymethylmethacrylate cements. Often these fasteners are not biodegradable. Since the Solution is also Ph neutral, it can also act as a delivery system for stem cells, growth hormones, protein and other biologics.
# Chapter 3: Current Uses and Products

## Our Products:

- **Sheeting**
- **Ceramic Cements**
- **Stuccos and Paints**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Use/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasives</td>
<td>As a binder in grinding wheels</td>
</tr>
<tr>
<td>Animal feed supplement</td>
<td>Source of magnesium ions for chickens, cattle and other animals</td>
</tr>
<tr>
<td>Boiler (oil-fired) additives</td>
<td>Raises melting point of ash generated to produce a friable material that is easily removed, reduced corrosion of steel pipes holding steam as well as sulfur emissions into the environment</td>
</tr>
<tr>
<td>Boiler feedwater treatment</td>
<td>Reduces iron, silica and solids</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Starting point for the production of other magnesium salts such as sulfate and nitrate</td>
</tr>
<tr>
<td>Coatings</td>
<td>Pigment extender in paint and varnish</td>
</tr>
<tr>
<td>Construction</td>
<td>Basic ingredient of oxycarbonate cements used for flooring, wallboard, fiber board, and tile</td>
</tr>
<tr>
<td>Electrical</td>
<td>Semi-conductors; heating elements insulating filler between wire and outer sheath</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>Source of essential magnesium for plant nutrition</td>
</tr>
<tr>
<td>Foundries</td>
<td>Catalyst and water acceptor in shell molding</td>
</tr>
<tr>
<td>Glass manufacture</td>
<td>Ingredient for specialty, scientific and decorative glassware and fiberglass</td>
</tr>
<tr>
<td>Insulation</td>
<td>Light, flexible mats for insulating pipes</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>Additive to neutralize acids</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>Special grades of magnesium hydroxide, oxide and carbonate are used in antacids, cosmetics, toothpaste, and ointments</td>
</tr>
<tr>
<td>Plastics manufacture</td>
<td>Filler, acid acceptor, thickener catalyst and pigment extender</td>
</tr>
<tr>
<td>Refractory and ceramics</td>
<td>Basic ingredient in product formulations for the steel industry</td>
</tr>
<tr>
<td>Rubber compounding</td>
<td>Filler, acid acceptor, anti-scorch ingredient, curing aid, pigment</td>
</tr>
<tr>
<td>Steel industry</td>
<td>Annealing process; coating for grain-oriented silicon steel used in electrical transformers</td>
</tr>
<tr>
<td>Sugar refining</td>
<td>Reduces scale build-up when used in juice clarification and precipitation</td>
</tr>
<tr>
<td>Sulfite wood pulping</td>
<td>Source of base for cooking liquors</td>
</tr>
<tr>
<td>Uranium, gallium and boron</td>
<td>Precipitation initiator by acid neutralization</td>
</tr>
<tr>
<td>processing</td>
<td></td>
</tr>
<tr>
<td>Wastewater treatment</td>
<td>Acid stream neutralizer; precipitates heavy metals</td>
</tr>
</tbody>
</table>
Over the past decade China has developed and used MgO as replacement for gypsum drywall and cement board because of the availability of local resources. MgO being one of its largest of those.

Today hundreds of projects have used this board around Asia, mostly commercial. Including Taipei 101, currently the tallest building in the world.

The boards were approved for use in America around 2003, New York and New Jersey consumed around 80% of the 500,000 sheets installed in 2005, due to the new fire and safety, building code and regulation changes.

Florida has recently adopted this product for its water/mold proof abilities. It is hurricane and impact tested and approved in Miami-Dade County.

Turkey is doing research now into making SIPS (Structurally Insulted Panels) All from MgO board.

The World Olympics MgO Sheeting is the “official” specified construction material of the 2008 World Olympics buildings, with over 8 million sf of MgO sheeting installed.

China has just formed a group of 700 of the leading MgO sheeting manufacturers, similar to the PCA (Portland Cement Association), of America. To ensure and promote, quality control, industry standards and overall product advancement.
Several new and old companies are now using MgO Cements to make a wide variety of innovative products. The design applications are endless!
Mineral Stuccos and Paints

And for Healing “Sick” Bridges and Buildings, teaching the Portland cements how to properly breath.

For Professional Restoration:

Or for new construction, where thought went into; the Health, the Longevity, and the Sustainability of the finish system.
Chapter 4: Applications and Specifications

- FireProof-Board
- Water/Mold-Proof
- Non-Toxic Alternative
- Ceramic Cement
- Binders and Treatments
- Stuccos and Joint Compounds
- Paints and Sealers
3.5 Hour Fire Rating using SEB:
UL Classified ATSM G21/G22
**One** 7/16” (10mm) sheet on each side of a 3½” steel frame wall. It has a 0/flame spread and 0/smoke propagation.

Georgia-Pacific **3 Hour** Fire-Wall Specifications:
**Three** ½” layers on each side of 1-1/2” steel studs. It has a 0/flame spread, 10/smoke propagation. (toxic black smoke)
MgO sheeting is completely water proof. It will not disintegrate when immersed in water or exposed to freeze/thaw cycles for prolonged periods of time, but 98% vapor permeable, and can take the place of other plastic film vapor layers. Commercially, for exterior sheeting, the standard is to paint on toxic tars over fiberglass covered gypsum, which have many toxic materials added. Great care and effort go into keeping the sheets completely dry during construction and throughout its life, as it will swell, rot and disintegrate. Contractors often have to remove and replace gypsum sheets, ruined from site conditions and weather damage.

MgO based sheeting is a non-nutrient to mold or fungus, and does not support insect life. It provides superior moisture resistance in high-humidity areas and combats the growth of mold and mildew.
Non-Toxic and Environmental

MgO sheeting and stucco has:
- No organic solvents
- No oils
- No toxic ingredients
- No heavy metal salts
- No asbestos
- No Silica
Binders and Treatments

- Treat your frame and lumber with a MgO, clay treatment, and protect your lumber from mold, fire and insects!
- It takes 48 hours for mold to start its growth. Clay treatment promotes hydration, when combined with vapor permeable insulation, sheeting and coatings. This never gives mold a chance to start.
- It also gives a significant amount of protection for: Fire, Insects and Decay.
1. Design the walls to breath. (Sick Building Syndrome)

2. Design the walls to protect you. (EMF)

3. Design your environment to resonate at a natural biological level. (Living Materials)
Pricing

- Mgo Board
- Raw Materials
- Contracting and Consulting

Prices vary, due to changing shipping charges. Please contact us for up to date pricing.
Thank you!

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2. Take Survey
3. Report GBCI

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