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## WALLS & CEILINGS

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### MgO Board

By RobertThomas

#### *A Primer on the Next Generation of Sheathing*

When I worked for a major metal wall system product manufacturer in the '70s, I once got in hot water by being too honest. I told top management, "We have a problem." The problem was called EIFS, and we were losing business to them—and for a good reason: EIFS was "a better mouse trap." I was right, and EIFS subsequently set the wall-cladding market on fire. When I first ran into MgO board in my work overseas, it reminded me of my EIFS experience. Read this article and you'll see why.

#### **What Is MgO Board?**

Magnesium oxide board "MgO board" is a factory-made, non-insulating sheathing board product. It can be used for a number of applications including wall and ceiling linings, fascias, soffits, tile backing and underlayments. It is made of magnesium oxide, a type of mineral cement, and is commonly called simply "MgO" (pronounced emm-gee-oh) due to its chemical composition of magnesium (chemical symbol Mg) and oxygen (chemical symbol O). Think of MgO as a type of sheathing board—sort of like drywall or cement board—but with much-improved characteristics such as fire resistance, weatherability, strength, resistance to mold and mildew, and so on.

MgO is available in many forms, and for building construction comes in various thicknesses and sheet sizes. It also comes in various grades, such as smooth finishes, rough textures, and utility grades. It is white, beige or light gray in color, and has a "hard" sound when rapped with your knuckles—somewhat like portland cement board. There are dozens of companies that make MgO board, most of which are in Asia. There are several large producers, but most are small local manufacturers who serve a region.

Not much MgO is used in North America so far, but no doubt will become much more widely used in the future.

#### **What's it made of?**

Pure magnesium is a silvery metal element (it is shown in the chemistry Periodic Table) and is a solid at room temperature (unlike mercury, also a metal, which is liquid at room temperature). Magnesium is somewhat like aluminum, but lighter. The so-called "mag wheels" on sports cars in the '60s and '70s were actually mostly made of aluminum, but also had some magnesium in them. Like aluminum, magnesium is usually used in alloy form, particularly for lightweight high performance structures like airplanes and race cars.

Pure magnesium, in raw form, is not stable—it burns—they make flares and fireworks from it. MgO, however, is the exact opposite. It is completely nonflammable and used for fireproofing and as furnace liners.

Oxygen, when combined with magnesium under heat and pressure can produce a stone-like material: MgO. MgO exists in gigantic deposits as raw "rock" and is mined like other minerals. It is ground up into a powder, which is then combined with water to make a cement-like (adhesive) material. About 70 percent of the world's MgO is in Asia. Other

deposits are located elsewhere around the globe, but not all have the correct quality for making sheathing. There is sufficient mine-able MgO spread around the world to make enough "MgO drywall" for centuries. MgO board also contains other magnesium-based components, but MgO is the main one.

### **What Else Is In MgO Board?**

In addition to the base material of MgO, other types of magnesium 'cements', wood flour, and various additives are included to improve manufacturing and enhance various properties. Most MgO boards have some type of fibrous reinforcement within the core and/or on the face. Often this takes the form of glass mesh, fibers, or a fine screed. MgO boards also contain other additives to enhance flexibility and weather-ability. In other words, there are various types of MgO boards, but most are essentially the same in terms of their basic composition.

MgO boards are made as individual pieces that are cut to length as they are poured onto a casting tray. The initial set occurs horizontally, but the final cure occurs vertically or with spacers between the sheets. The MgO is cast in a liquid slurry-like form (a mixture of MgO powder, and other additives and water) and sets up by chemical reaction - much like portland cement does in stucco or concrete. The cast boards are then cured at ambient temperature. MgO boards do not contain asbestos, but some have different types of micro fiber reinforcing. This reinforcing is separate from the surface scrim, and is part of the MgO slurry used to cast the MgO sheets.

MgO is made in a number of areas around the world, and especially near areas where MgO deposits are mined. Major deposits of MgO do not occur in the USA and Canada; China and the Mideast have large deposits.

### **History of MgO**

The use of MgO goes back many centuries, almost to the Pyramids. It was originally used to make mortars for masonry construction. Nowadays, in many countries, MgO is often used for mortars. In North America, portland cement is used most of the time.

The modern use of MgO to make sheathing panels goes back several decades. MgO boards have been used in Asia and the Middle East on many large, world-class projects, particularly for partitions and fire walls. This new-to-us type of sheathing has a long, successful track record.

MgO boards come in various forms. The thinnest boards are about 1/4-inch thick, while the thickest are about an inch. Sheet sizes are similar to those of drywall.

Various surface finishes are available for MgO board. Some are super smooth and paintable as-is, while others are rougher and better suited for non-aesthetic purposes, such as structural sheathing or a tile backer board, or for the application of thick coatings.

MgO board is a "low tech" and "energy-friendly" product. CO<sub>2</sub> is high on the list of "greenhouse" gases, which are said to contribute to the global warming phenomenon. MgO production is simple, energy efficient, and produces few "greenhouse" gases. This aspect of MgO, from the standpoint of being a 'green'/eco-friendly product, would indicate that MgO-based products would have a bright future.

### **POSSIBLE USES**

In many applications, MgO boards can be used in the same ways as gypsum and portland cement sheathings. The substitution is not fully direct in terms of sheet thicknesses, fastening methods and joint treatments, but is very similar. This makes MgO board an easy product to use. The possible uses of MgO board are vast, and some of them include:

- Fire walls.
- Partitions.
- Structural sheathing for wood or metal stud walls.
- Shower stall tile backer board.
- Facings for structural panels engineered to use MgO as the facing.
- Shaft liners.
- Ceilings.
- Soffits.
- Fascia.
- Substrates for coatings and insulated systems (such as Direct-Applied Finish Systems, EIFS, and stucco).

## **MGO VS PORTLAND CEMENT**

MgO boards are harder than drywall, and are somewhat like the portland cement board used in bathtub enclosures. MgO is 'worked' in a manner like a combination of drywall and cement boards. It can be scored and snapped, although it is stronger than drywall and requires a bit more effort. It can be cut with a power saw, drilled-through and fastened like other similar boards. As when sawing portland cement boards, dust is created and thus precautions against inhalation need to be taken, but the dust itself is basically inert. It's an easy-to-install product.

Like any sheathing board, MgO board can absorb water but its performance is unaffected. Thus it can be used indoors and outdoors, and in damp locations, such as showers. Like portland cement based sidings, if MgO is used outdoors in an exposed location, it needs some form of coating, such as paint. MgO can be used structurally—as in bracing for walls—and also semi-structurally, such as an underlayment for flooring.

MgO boards are not completely homogeneous (they are like portland cement boards that have a glass scrim in the face), but do not have a separate facing like drywall or glass matt-faced gypsum board. Hence delamination is not an issue—for practical purposes it is a solid material.

MgO board is more flexible than portland cement boards and less flexible than drywall. Thin sheets of MgO can be bent or warped to follow gentle curves. MgO is not as brittle as portland cement boards, but "edge distance" (closeness of fasteners to the edge of a sheet) is an issue in using certain types of fasteners. For instance, it can be nailed, but the hammering of the surface by the tool when setting the nail can damage the surface, although the nail itself does not. It's basically like drywall or cement boards, in terms of ease-of-installation.

MgO board is quite stable. When subjected to temperature changes, it does not expand or contract much, nor does it absorb much water, or swell, when wet.

When installed like drywall as a facing for partitions or as fire walls, the joints between MgO boards are treated much like drywall, using joint compound and a light mesh scrim.

### **Suitable for structural sheathing**

MgO board is quite strong and has good flexural and tensile strength, making it suitable as a structural sheathing, such as would occur with stucco, or as a substrate for EIFS. It also has high impact resistance, making it good for damage-prone applications, such as hurricane areas, or when used with a simple surface coating in areas where the wall might get beat up.

No doubt you are aware of the current level of concern about mold and mildew. MgO board does not support the growth of mold or mildew at all, as there is nothing in MgO board that is attractive to mold and mildew. Similarly, termites and other insects have no interest in it, as it is inedible.

The fire properties of MgO boards are similar to gypsum boards. It is technically noncombustible in terms of the building codes and has a "zero" flame spread and smoke developed rating. MgO board does not burn at all, and can often be substituted thickness-for-thickness for Type X drywall in fire rated wall assemblies. Some proprietary MgO systems have been tested in two-, three- and four-hour UL-rated assemblies.

Being a stone-like material, MgO board has limited thermal insulation value, like gypsum and portland cement products.

The surface of MgO board, although it can be made very smooth, is slightly absorptive, making it possible to paint and bond-to the surface. This makes it good for applications like ceramic tiles, and thin, synthetic stuccos, adhesives, and EIFS.

In terms of weight, MgO board, on a thickness-to-thickness basis, is about 20 percent heavier than drywall, depending on the density of the MgO board. It is about 20 percent lighter than portland cement sheathing boards.

The cost of MgO boards is similar to cement boards, on a per-thickness basis. The variation in price of MgO is mostly based on transportation costs, and varies with the geographic location of the end user, as shipping is a major cost component. Labor costs would also be similar to portland cement boards.

### **The Right Stuff**

If you are getting the impression that MgO is an impressive type of sheathing, you are correct. And thus an obvious question would be “Why isn’t it used more in the USA?”

The answer has to do with the history of the product’s development, production improvements, and the free trade policies that are making products from around the world available almost everywhere.

The emerging MgO board industry in the USA is well along in developing the necessary technical backup information to allow its use in our market. This includes basic documents like design data, structural and fire testing, installation standards, specifications and code approvals. Once this data is available, the market should open quickly.

From a production standpoint, the lack of raw MgO from mines in North America from which to make the boards, is a major factor in producing the board on this continent. Also, the labor intensiveness of the production process requires low cost labor. A significant portion of the cost of a sheet of MgO board is getting it from the factory to the distributors, so low-FOB prices are essential. Virtually all MgO board comes from overseas, and a significant portion of the cost can be in ocean shipping to get it to the North American coasts.

Currently MgO board is available from several commercial distributors who have business alliances with the producers overseas. As with any new product, credibility of the manufacturer and quality of their product is key to meeting job specifications and expanding the market. Quality MgO suppliers should be able to provide testing and other technical data performed at U.S. facilities.

MgO board is all about new technologies and progress. Production and distribution of MgO board is being expanded rapidly to meet the high demand around the world—including the potentially enormous North American construction market. As the use of MgO increases in North America, W&C will keep you up to speed on this impressive product.



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