The comeback of hydrated lime (lime putty): creating a healthy indoor microclimate

It is urgently necessary to commit to energy savings, the preservation of historic and architecturally valuable buildings, and the construction and renovation of modern buildings in complete harmony between humans and the environment.

Our genetic code binds us to the earth and the natural habitat, thus interacting with it in a harmonious relationship... we should simply follow our instincts.

Green building and sustainability

The main goal of building green is to avoid damaging historic structures, thus preserving and restoring them with compatible materials—materials from the past that are still relevant today, though too often forgotten. Preserving the environment by using mineral and plant-based products and significantly reducing—or completely eliminating—the negative impact of buildings on both the environment and their occupants, in harmony with the surrounding context.

This is achieved through passive strategies, giving preference to eco-sustainable materials and practices—completely natural building materials—with the goal of improving the environmental quality of buildings, drastically reducing the impact on the ecosystem, and creating an ideal microclimate and thermo-hygrometric balance in harmony between the environment and the individual.

The use of natural materials (in our case, lime putty) allows historic masonry to maintain a hydrometric balance which, if different materials were used,

would be lost—causing damage to the structure, decorations, and frescoes.

Hydrated Lime: Beauty and Functionality

Hydrated lime is not only beautiful to see and breathe.

Just think of its wonderful applications in buildings considered among the world's finest architectural masterpieces—coated with its plasters, stuccoes, decorations, frescoes, and paintings.

It is also a symbol of purity, standing in contrast to the pollution of modern times and helping us change our lifestyles based on values that may seem outdated, yet are increasingly relevant today.

Advantages of Hydrated Lime

Some examples of the benefits of hydrated lime:

- **Environmental respect** thanks to its recyclability without any harmful impact on the surrounding area.
- **Health safety for people**, who can avoid potential respiratory and other illnesses caused mainly by mould and bacteria, eliminated by this material.
- **Psychophysical well-being** due to its ability to regulate excess or insufficient humidity in enclosed environments.
- **Long-lasting durability** in every application, breaking away from the "quick-fix" logic of modern construction, where most materials require frequent touch-ups and monitoring.
- **Exceptional insulating power** through the use of nanotechnology.

Yesterday, today and tomorrow

The past has merged with the present and future to give rise to a revolutionary product with surprising properties.

Traditional lime has now combined with nanotechnology—AMORPHOUS SILICA (commercially known as Aerogel)—greatly enhancing its insulating performance.

In this way, thermal plaster offers high insulation capacity with minimal thickness, far superior to all other synthetic and natural materials on the market.

Unlike synthetic materials that lose much of their insulating ability over time, nano-porous hydrated lime, through the carbonation process, actually improves its insulating capacity over time.

In cold, damp homes with high thermal energy loss, applying this material in thicknesses ranging from fractions of a millimetre to under one centimetre can raise the temperature of perimeter walls by 2 to 7°C.

The increase in the surface temperature of walls prevents the formation of mould, which, in any case, would be “neutralized” by aerial lime.

Moreover, the reflective properties of aerial lime help maintain a nearly constant indoor temperature, thereby preventing the formation of interstitial condensation **within** the walls.

Additionally, the high breathability of aerial lime allows water vapour molecules to pass through, enabling the building to "breathe"—a process increasingly hindered by the use of synthetic, non-breathable materials.

Outdoor Benefits: Avoiding the **“Urban Heat Island” Effect**, Hydrated lime helps prevent the phenomenon known in meteorology and climatology as the urban heat island—a microclimate effect that causes urban areas to be significantly warmer than surrounding suburban and rural zones.

Why Hydrated Lime?

The NATURAL CALK product line, in its entirety, delivers a complete “lime system” that eliminates thermal load on buildings, thus significantly reducing internal heat accumulation. With the help of solar radiation, it enables dehumidification and crystallization of fine dust, which is then removed by weather elements without damaging the building surfaces.

Hydrated lime promotes breathability

Studies aimed at identifying the most suitable binders for traditional construction have shown that hydrated limes—especially lime putty—provide the highest breathability for masonry. This is especially important in the repair and restoration of historic and artistic buildings. The calcite crystals formed during carbonation in lime-based products are much larger than those resulting from the hydration of hydraulic binders.

Their growth within pores saturated with calcium hydroxide solution results in a gradual increase in strength over time, while ensuring high permeability of mortars. In contrast, dense and impermeable cement-based mortars can trap moisture within the walls, often triggering or accelerating degradation mechanisms.

When rigid, low-permeability materials are used in restoration and come into contact with more porous, weaker ones, they can cause localized stress and structural damage.

Hydrated lime enhances comfort and health

The external and internal plasters, when properly hygroscopic like those based on lime putty, regulate indoor relative humidity optimally by absorbing and releasing moisture. This increases the comfort of the spaces, reduces condensation, and prevents the formation of mould. Aerial lime is highly alkaline and caustic, and due to this characteristic—which gives it strong antiseptic and disinfectant properties—it has been and still is used for sanitizing environments.

Self-healing properties of hydrated lime

When mortars formulated with aerial lime are subjected to vibrations and minor movements, they tend to develop many fine hairline cracks. In contrast, the use of hydraulic binders—especially cement-based ones—tends to result in fewer but wider cracks. In lime putty mortars and plasters, when water enters these fine cracks, it can dissolve any remaining calcium hydroxide and, in the presence of carbon dioxide, also calcium carbonate (as bicarbonate), transporting and spreading them. As soon as the water evaporates, the carbonate reprecipitates, the hydroxide is deposited, and subsequently carbonates, leading to a sealing process. This phenomenon is known as autogenous crack healing or self-sealing of cracks.

Excellent adhesion of lime putty

The ultrafine particles (of nanometric size) present in high-quality, sufficiently aged lime putty are able to penetrate more deeply into the tiny voids on the surface of the substrate, where they bond gently, thus developing excellent adhesion.

Lime mortars protect also adjacent materials

The high porosity and permeability of lime putty mortars, by appropriately regulating moisture transfer through their hygroscopic properties, allow for optimal protection of the brick and/or stone masonry surfaces to which they are applied.

Lime putty mixes offer excellent workability.

Workability refers to the ability of a mix to retain cohesion and plasticity, even when subjected to suction by porous materials, and to be easily shaped without excessive effort. This property is particularly outstanding in well-aged lime putties and is extremely helpful for achieving easy and optimal application of joints, plasters, stuccoes, and more.

Buildings constructed with aerial lime-based binders are durable.

The absence of potentially harmful chemical components—such as tricalcium aluminate and alkaline substances (potassium and sodium oxides), which are always present in hydraulic binders—makes hydrated lime putty mortars immune to the destabilizing and expansive effects of sulphates and the harmful alkali-silica reaction. As a result, structures using aerial lime-based binders are extremely durable, as evidenced by numerous examples—foremost among them the Pantheon in Rome—which demonstrate lime's remarkable ability to withstand the test of time.

Lime putty finishes also have great decorative value.

The double refraction of calcite crystals gives lime putty finishes a unique effect, thus, combining a soft surface texture with a sheen that adds vibrancy and aesthetic appeal to masonry surfaces. Lime putty finishes age gracefully—they do not tend to form films or detach but instead wear and degrade in harmony with the substrate.

Aerial lime is ecological, economical, and enhances regional identities.

It is fired at lower temperatures than hydraulic binders, requiring less fuel and therefore producing lower carbon dioxide emissions.

Moreover, during carbonation, nearly all the CO_2 lost during calcination is reabsorbed, effectively reducing the environmental impact. Aerial lime can also be produced locally, further saving energy through reduced transportation and providing additional environmental benefits.

The different types of limestone found across different regions result in lime products with unique colours, textures, and properties that reflect and enhance local identities. Lime is also economically advantageous thanks to its excellent volume yield—when used in plasters, its dosage can be up to 50% lower than that of ordinary hydraulic binders for the same surface coverage.

Lime putty is the ideal binder for the restoration of historical, artistic, and architectural heritage.

Aerial lime binders are the only ones reliably compatible with the materials characteristic of historic and artistic buildings. Chemically, they do not react with pre-existing materials and do not lead to the formation of unstable, incoherent, or generally harmful compounds. From a physical standpoint, they exhibit values of elastic modulus, mechanical strength, thermal expansion, and porosity that are equal to or lower than those of ancient materials.

Unlike cement-based binders, lime-based mortars maintain breathability, thus allowing the masonry to “breathe,” which ensures the long-term preservation of all its components. The natural colour of lime mortars—and the full chromatic range achievable by adding sands and earth pigments—blends harmoniously with the appearance of traditional materials, both natural (such as stone) and man-made (such as bricks).