

A modern building with a glass and stone facade. The glass reflects the surrounding greenery and sky. The stone is a dark, textured material. The building has a flat roof and large windows. The overall style is contemporary and minimalist.

**Laplitec®**  
Prestigious Italian Surface

# SINTERED STONE

## A NEW MATERIAL CATEGORY ENTERS THE MARKET

## PROGRAM REGISTRATION

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# COURSE OVERVIEW

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Sintered stone is a new material so unlike ceramic, or natural stone that it warrants its own category for building standards, which are now being developed in Europe. This course demonstrates that sintered stone has the workability of natural stone with the sustainability and performance of ceramic. This new material is durable to whatever threat may come, either by nature or humans. The course shows how sintered stone is used in a wide variety of indoor and outdoor applications from countertops to flooring, walls, cladding, and more.



# LEARNING OBJECTIVES

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Upon  
completing this  
course, you  
should be able  
to:

- Explain what sintered stone is (and is not) and where it is used
- Discuss the sintered stone manufacturing process
- Define the characteristics and sustainability factors of sintered stone
- Assess the performance and testing of sintered stone
- Identify the many applications for sintered stone in residential, commercial, and institutional building projects



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# SECTION

A New Category of  
Material



# A NEW CATEGORY OF MATERIAL

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## Workability and sustainability

- Workability of natural stone
- Sustainability and performance of ceramic
- Next step in evolutionary chain of mineral-based materials



# A NEW CATEGORY OF MATERIAL

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## Unique production process and characteristics

- Not ceramics
- Not reconstituted stone
- Not natural stone
- BRE established new material category: sintered stone

# A NEW CATEGORY OF MATERIAL

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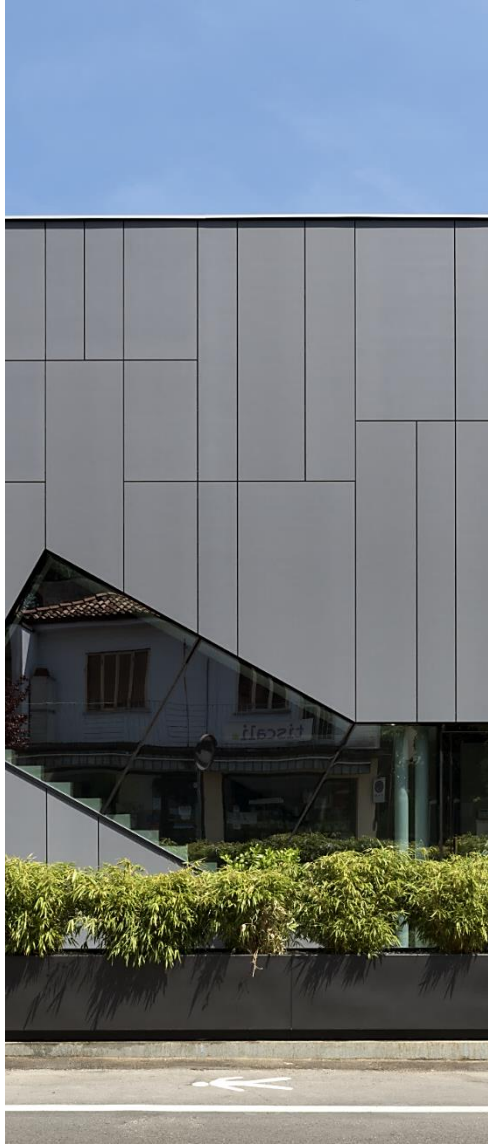


## How sintered stone was developed

- Developed by Italian company
- Over a 22-year period between 1989 and 2011
- First slab hit the market in 2012



# A NEW CATEGORY OF MATERIAL



## Applications for sintered stone

- Interior
  - Interior wall cladding
  - Interior stair cladding
  - Kitchen counters
  - Bathroom surfaces
- Exterior
  - Wall cladding
  - Rainscreen cladding
  - Swimming pools
  - Outdoor kitchens and barbecues
  - Paving

# A NEW CATEGORY OF MATERIAL

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## Difference between ceramic or porcelain and sintered stone

- Main difference is workability
- Ceramics produced by high pressure and extrusion
- Sintered stone produced by 'vibro-compression under vacuum'

# A NEW CATEGORY OF MATERIAL

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## Comparison of ANSI Standards

Ceramic: “Tile made from clays and/or other inorganic raw materials, usually shaped by extruding (Method A) or dry-pressing (Method B) at room temperature followed by drying and firing at temperatures sufficient to develop required properties; tiles can be glazed (GL) or unglazed (UGL).”

Sintered stone: “Industrial products made of a wet mixture of natural minerals, without use of resin or cement, cold-formed by means of vibro-compression under vacuum and consolidated, after drying, by sintering between 1100 degrees and 1200 degrees Celsius; the process is reversible. Sintered stones are full body, workable as natural stone upon the entire thickness, put on the market in the form of rough slabs, slabs, tiles and any other cut to size products.”





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# SECTION

The Sintered Stone  
Manufacturing Process



# THE SINTERED STONE MANUFACTURING PROCESS

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**Vibration and compression analogous to natural geological processes**

- Vibration and compression produce natural stone such as sandstone or marble
- Natural formation takes millions of years
- Natural material can be inconsistent
- New material invariably consistent, homogenous, and predictable



# THE SINTERED STONE MANUFACTURING PROCESS

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## Manufacturing process: Forming

- First and most innovative part of process
- Powdered raw materials compacted under vacuum with vibration and compression
- Slabs so dense they can be stored vertically without failure or damage

# THE SINTERED STONE MANUFACTURING PROCESS

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## Manufacturing process: Firing

- Powder particles bonded through sintering
- Fusing matter without reaching its melting point
- Atomic diffusion process creates very strong bonds between molecules
- Pore spaces all but eliminated

# THE SINTERED STONE MANUFACTURING PROCESS

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## Manufacturing process: Finishing

- Can be finished like stone
- Higher gloss or rougher texture possible
- Can be cut to size, leaving presentable edge





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# SECTION

Characteristics of Sintered  
Stone



# CHARACTERISTICS OF SINTERED STONE

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## Characteristics: Expressive

- Range of textures allows for subtle variations in appearance
- Finishes offer a range of tones
- Especially pronounced in cladding with changing lighting conditions



# CHARACTERISTICS OF SINTERED STONE

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## Characteristics: Versatile

- Panels not fixed-size products
- Can be transformed in many shapes and sizes
- Can be cut and perforated like stone

# CHARACTERISTICS OF SINTERED STONE

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## Dimensional characteristics

- Cost per square meter relatively unaffected by size
- Cost effective when used in large formats
- An option for larger panels in contemporary architecture

# CHARACTERISTICS OF SINTERED STONE

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## Modular dimensions

- Smaller modules are available
- Slabs can be cut in factory
- Three slab thicknesses standard in industry
  - 12mm (approximately ½ inch) is adequate for most applications
  - 20mm and 30mm versions may also be available



# CHARACTERISTICS OF SINTERED STONE

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## Full bodied and homogenous

- Homogenous in appearance and performance throughout material
- Unlike porcelain, which is full colored in appearance but not performance

# CHARACTERISTICS OF SINTERED STONE

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## Translucency possible

- Translucency give materials extra sense of depth
- A consequence of light penetrating and reflecting
- Translucency possible when 12mm material is machined down



# CHARACTERISTICS OF SINTERED STONE

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## Textured, Honed, and Polished Finishes

- Surface finished applied using same machinery and techniques as for natural stone
- Different from finishes pressed onto porcelain tiles
- Finishes from highly polished to heavily roughened

# CHARACTERISTICS OF SINTERED STONE

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## Veining

- Not achieved through surface digital prints
- Achieved using 'powder drop method'
- Each slab is unique
- Veining runs through the body of the slab



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# SECTION

Sustainability Factors of  
Sintered Stone





# SUSTAINABILITY FACTORS OF SINTERED STONE

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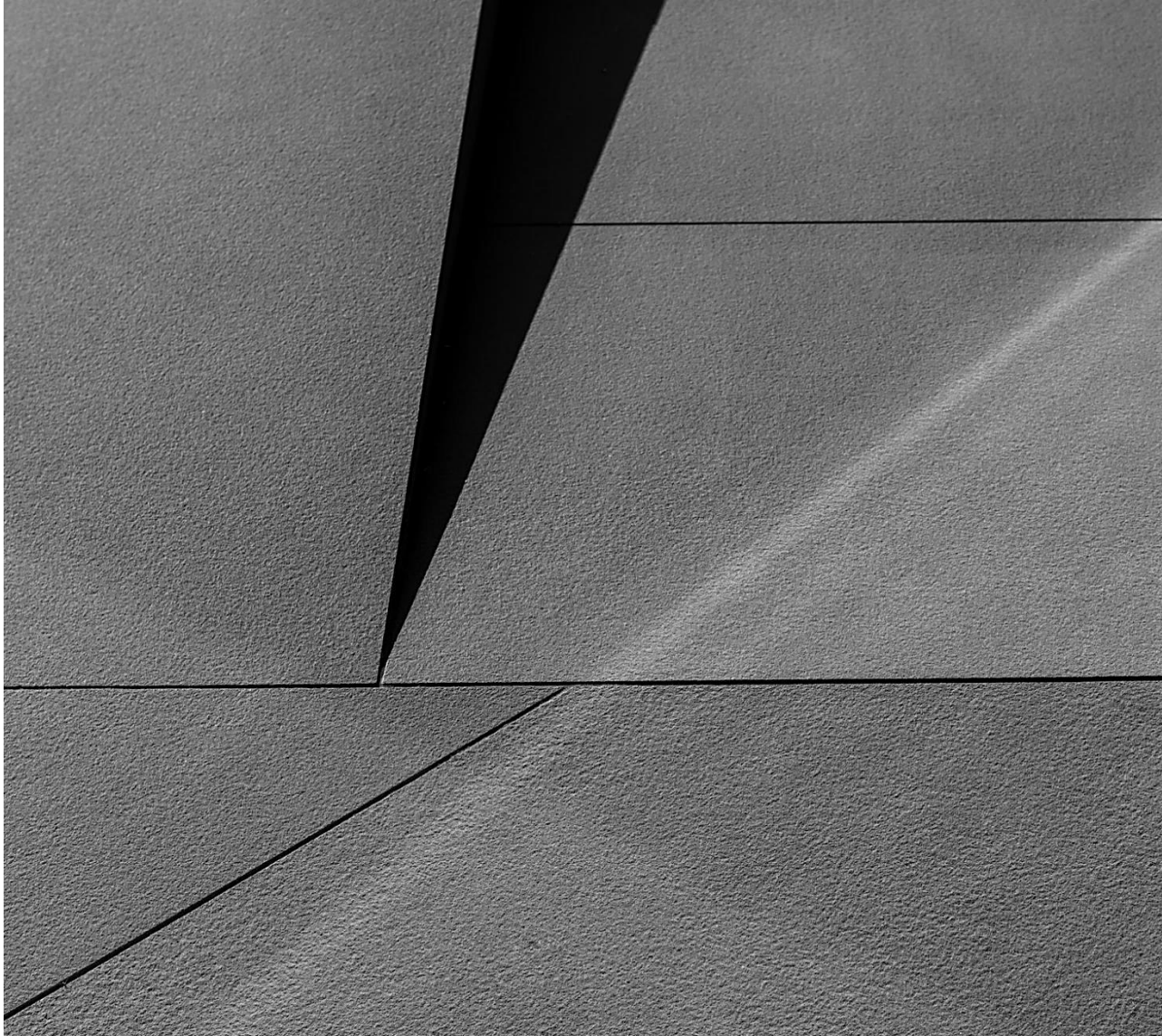


## Durability

- UV stability
- Ease of maintenance
- Inert

# SUSTAINABILITY FACTORS OF SINTERED STONE

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## 100 percent natural materials

- Feldspar
- Kaolin
- Other minerals
- Metal-oxide pigments

# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Recyclable and reversible process

- Can be broken down into constituent ingredients
- Can be processed into new slabs
- Factory waste recovered and reused



# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Inert and nontoxic

- All raw materials nontoxic
- No need for binding resin
- No off gassing or emissions of VOCs
- Classified as food safe

# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Efficient process

- High-efficiency kilns
- Recycled water
- Power from photovoltaics



# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Minimal production waste

- Exacting production process
- Low percentage of panels that do not meet quality standards
- Water use in production nontoxic and can be recycled



# PERFORMANCE AND TESTING OF SINTERED STONE

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## High strength

- Strength allows large cantilevers
- 30mm version can overhang 500mm unsupported
- Flexural strength meets EN 14617-2 Standard with the test result of 53 N/mm<sup>2</sup>

# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Not a so-called ‘monstrous hybrid’

- “Monstrous hybrid” phrase attributed to Cradle to Cradle co-author Dr. Michale Braungart
- Binder-free production permits recovery
- No resin to bind materials

# SUSTAINABILITY FACTORS OF SINTERED STONE

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## Surfaces and edges

- Bullnose and complex edges
- Carved edges
- 3-D details
- Water jet cut forms
- Precision forms
- Inlays
- Graphics and logos





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# SECTION

Performance and Testing  
of Sintered Stone



# PERFORMANCE AND TESTING OF SINTERED STONE



## Scratch resistant

- Sintered stone is between 5 and 6 on Mohs scale of mineral hardness
- Similar to hardness of glass but with considerably better impact resistance
- Meets abrasion resistance standard with a test result of 140mm<sup>3</sup>, 5.5 inch
- Some granites measure up to 170mm<sup>3</sup> or more



# PERFORMANCE AND TESTING OF SINTERED STONE

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## Impact resistant

- Almost double the resistance of porcelain tiles
- Virtually no damage will occur when items are dropped on the sintered stone floor
- Meets standard EN 14617-6 with test results of 1.97 Joule (12 mm/1/2 inch) and 3.30 Joule (20 mm/3/4 inch)



# PERFORMANCE AND TESTING OF SINTERED STONE

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## Low coefficient of thermal expansion

- Coefficient of thermal expansion of  $5.8 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$
- Lower than that of porcelain
- Five times lower than that of reconstituted stone
- Meets the 14617-11 Standard: Determination of Linear Thermal Expansion Coefficient

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Dimensionally stable

- Meets the EN 14617-12 Standard: Dimensional Stability Test for Moisture Sensitivity of Stone with a test result of A

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Thermally resistant

- Resistant to thermal shocks
- Direct contact with hot pans will not scorch or shatter the surface
- Equally resistant to cold and freeze-thaw cycles
- Meets the EN 14617-5 Standard for frost resistance.



# PERFORMANCE AND TESTING OF SINTERED STONE

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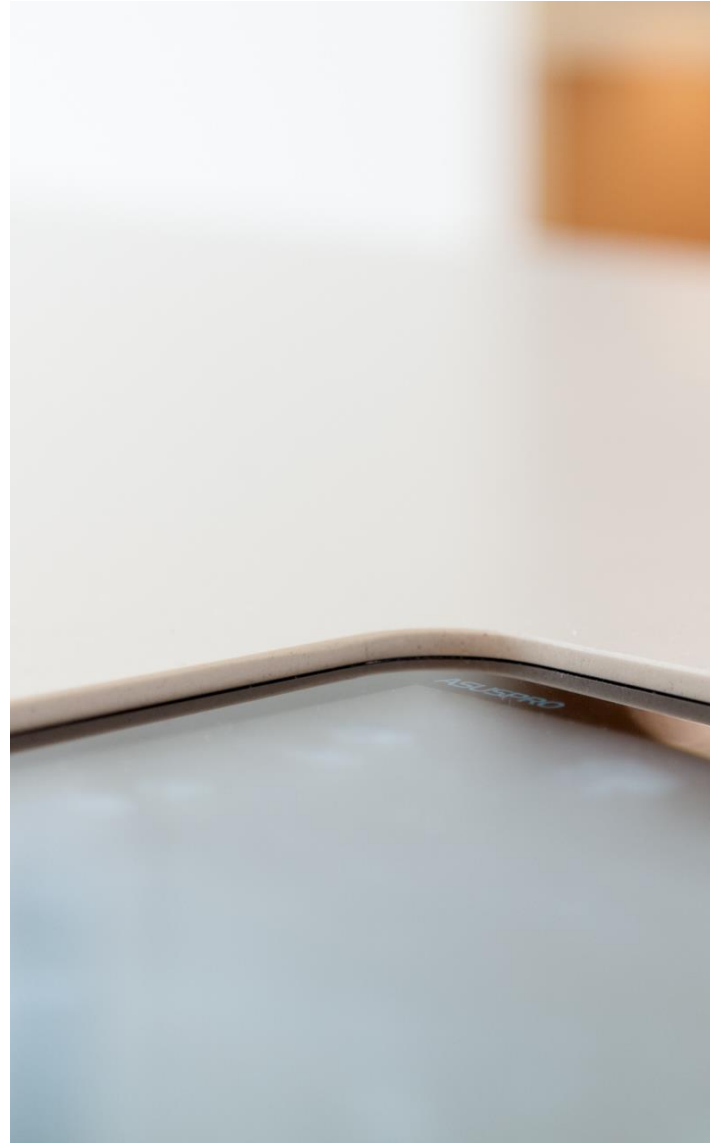


## Chemically resistant

- Resistant to acids and bases
- Ensures unchanged appearance over time
- Meets the EN 14617-10 Standard with a test result of C4-Resistant

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Non-porous

- Absorption less than 0.02 percent
- Hygienic and stain-resistant
- Meets water absorption standard ASTM C97 with a test result of 0.03 percent
- Meets the EN 14617.1 Standard with a test result of 0.02 percent

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Non-combustible

- 100 percent mineral based
- Receives A1 classification under EN 13501-1
- Receives A2 rating for cladding because of safety mesh required on back



# PERFORMANCE AND TESTING OF SINTERED STONE

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## UV stable

- Mineral base ensures UV stability
- Meets the DIN 51094 Testing of the Light Fastness and Color Fastness of Ceramic Tiles for Walls and Floors Standard with a test result of “No Change”

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Slip resistant

- Can achieve high slip resistance requirements up to 60 in wet pendulum test values (PTV)
- Can be specified in pure white color with slip resistance, unlike marbles
- Some sintered stone finishes achieve PTV values over 36 in a wet environment

# PERFORMANCE AND TESTING OF SINTERED STONE

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## Food safe

- Suitable for furnishing of food and beverage premises
- Meets the Standard NSF/ANSI 51 for Food Equipment Materials





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# SECTION

Limitations of Sintered  
Stone



# LIMITATIONS OF SINTERED STONE

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## Not bendable

- Very rigid
- Low malleability
- Used for flatness and solidity

# LIMITATIONS OF SINTERED STONE

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**Does not replicate the aesthetic of natural stone**

- Cannot compete with sheer beauty and decorative figuring of natural stone
- Is appreciated for consistency and uniformity



# LIMITATIONS OF SINTERED STONE

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## Is not inexpensive

- Cost effective, but not inexpensive
- Not the right product for rock bottom budgets
- Suitable for the front of a building, rather than the back



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# SECTION

Architectural Applications  
for Sintered Stone





## RECYCLING CENTER<sup>2</sup>, FLOORING

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- Project: Recycling company headquarters
- Completion date: December 2017
- Material used: Sintered stone
- Application: Facade cladding, flooring

<sup>2</sup> <https://www.lapitec.com/projects/sintered-stone-cladding-for-the-eurovetro-headquarters>



# SKYSCRAPER LOBBY<sup>3</sup>, INTERIOR CLADDING

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- Project: Entrance hall of skyscraper building
- Date of completion: September 2017
- Material: Sintered stone

<sup>3</sup> <https://www.lapitec.com/projects/sintered-internal-stone-cladding-for-a-new-york-skyscraper>

# MANUFACTURING COMPANY HEADQUARTERS, RAINSCREEN FACADE<sup>4</sup>

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- Project: Commercial building
- Date of completion: March 2019
- Material: Sintered stone
- Application: Ventilated facade

<sup>4</sup> <https://www.lapitec.com/projects/Breton-Headquarters>

## PIZZA RESTAURANT, BAR COUNTER<sup>5</sup>



- Project: Pizza restaurant
- Completion date: September 2017
- Material used: Sintered stone
- Application: Bar counter and table

<sup>5</sup> <https://www.lapitec.com/projects/lapitec-domino-s-pizza-bar-counter>



# CHEMICAL LABORATORY<sup>6</sup>, BENCH TOPS

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- Project: Laboratory benches
- Completion date: December 2017
- Material used: Sintered stone
- Applications: Bench tops for the chemistry laboratory

<sup>6</sup> <https://www.lapitec.com/projects/laboratory-benches-high-school>

# SWIMMING POOL<sup>7</sup>, SURFACES

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- Project: Outdoor entertainment area
- Date of completion: August 2017
- Material: Sintered stone
- Application: Pool surround and summerhouse cladding

<sup>7</sup> <https://www.lapitec.com/projects/Canvey-Island>

## SPA, FLOORING<sup>8</sup>

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- Project: Spa
- Date of completion: March 2017
- Material: Sintered stone
- Application: interior wall cladding and flooring for spa

<sup>8</sup> <https://www.lapitec.com/projects/interior-wall-cladding-and-flooring-for-spa-lapitec>





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# SECTION

Conclusion



# THANK YOU

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Thank you for your interest in “Sintered Stone: A New Material Category Enters the Market.” This concludes the American Institute of Architects Continuing Education Systems Course.

Please contact Lapitec directly if you have any questions about the material presented in this course.

[www.lapitec.com](http://www.lapitec.com)

Please take the following quiz for your AIA credits

# REFERENCES

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- <https://www.bregroup.com>
- <https://www.lapitec.com/projects/sintered-stone-cladding-for-the-eurovetro-headquarters>
- <https://www.lapitec.com/projects/sintered-internal-stone-cladding-for-a-new-york-skyscraper>
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