

ENAMEL and DESIGN

The Potential of enameled materials in design applications

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INTRODUCTION

To increase the use of enamel it's necessary to spread the knowledge of enameled products. It is fundamental to expand the market beyond its traditional sectors. Enameled objects have a high potential for wide application in the area of design.

Design is one of the targets.

The conception of a product can be advantaged by the properties that enameled surfaces exclusively can offer. Designers perceive shape as the essence of an object; but when there is the chance to “dress” a product with an enameled skin they will certainly consider the possibility.

There was a need for a book addressed to design – a book meant to introduce enameled metals, stimulate the curiosity of designers and architects **that there“ is the possibility to use enameled metal to make their creations successful ”**.

A product conceived for sale is seen as unique not only for its functional but also for its aesthetic-perceptive features. The enameled metal combines unique technical properties with a wide range of colors and the possibility to create special texture and surface effects. Most people ignore its resistance to corrosion, color resistance throughout time, easiness to clean, its non-toxicity etc...

The purpose of the book **“Enamel and Design – The Potential of enameled materials in design application**, published by Fausto Lupetti , Bologna, Italy, in September 2011”, is to expose the material's characteristics and peculiarities including some very particular applications in order to promote the use of the enameled metal for new realizations.

This book is certainly unusual for industrial enamellers being mainly descriptive and illustrated and organized in brief chapters without any technical information.

To make it attractive to experts and students, we start giving an overview of the origins and main historical stages up to present day enameling. Enamel can claim a long history. To plan the future possibilities we should understand the past. The first 3000 years have a typically artistic character. Industrial enameling started around 1750, but we lack the time to treat it and won't discuss it, though it could also be an interesting subject.

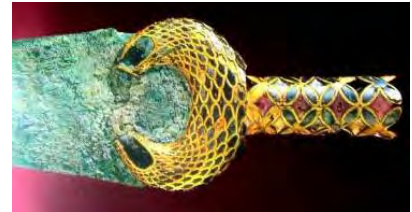
BRIEF OVERVIEW ON THE ORIGIN OF ENAMELING

Historically, enamel has been applied for the first time on ductile metals such as gold, silver, electrum (a gold-silver 20% alloy) and later on bronze and copper. During most of the 3000 years, production is almost limited to religious objects, items for personal use or jewelry. Its cradle lays probably between 1600-1400 BC in Greece and the Mediterranean area, from Mycenae to Cyprus. It is there where Mycenaean artisans, glassworkers and goldsmiths, that escaped from the Achaean invasion, created the oldest enameled objects found ever since.



On the left: bronze daggers, decorated with set metal, 16th century BC.

On the right: an enamelled cloisonné dagger, 15th century BC. Museum of Athens.



Glass, ceramic objects and jewels since 3000 BC are colored, decorated and often associated with noble metallic objects, either set or cemented together with precious stones.



On the Left: Vitreous Paste, Egypt, 5th millennium BC.

On the right: Tellus Ring, 3rd millennium BC, with set stones.



Around 1500 BC, in the Mycenaean area, goldsmiths and glassworkers discover a kind of glass similar to stone that melts to gold and binds permanently to metal. A dagger with enameled parts of that period is preserved in the Museum of Athens.

Some scholars guess the first use of enameling in Pharaoh Egypt or in Mesopotamia. However, there is no archaeological evidence and a famous scholar, Gardner, mistook enameled ceramics and colored glass for “**real enamel**”, for which the condition is to bind to the metallic surface by vitrification at high temperature (Dietzel). Only thanks to excavations the development of enameling can be studied during history. According to Higgins, the earliest production of blue enamels on gold was created in Mycenae around **1425 BC**. The few pieces available show the good quality of the craftsmanship.



**Enamelled Rings from the Mycenaean Tomb, 1,300 – 1,100 BC
Knob of the scepter of Kurion**

The oldest findings are set in the golden age of Cyprus (**1500 – 1200 BC**). A remarkable object is the 16 cm long golden scepter with golden handle found close to Episkopi (Curium), dated about 1100 BC. Its spherical top is enameled in semicircle cells alternating white, lilac and green. The craftsmanship and technique to work gold and enamel is impressive. During the centuries this technique became known as Cloisonné, from the French word Cloison, meaning “partition”.

It can be seen in the Museum of Cyprus, Nicosia, together with six golden rings with round enameled partitions, all excavated in a tomb in Kouklia, Cyprus, dated about **1200 BC**.

THE MOST IMPORTANT STAGES OF ENAMELING



**Example of
enamel filigree technique.**



There are no archaeological findings **between 1100 and 600 BC** ; it seems that this technique extinguished, to regain prominence in 6th century BC with works of filigree, in Azerbaijan (Dietzel). Also in Etruria, Magna Grecia, and Spain, particularly in Seville, there has been some production of enameled objects in 6th to 4th century BC (Gonzales). These works are very refined so that we believe that the practice was well known.

**Bronze fibula, roman champlevé,
3rd century AD, (Vaison la Romaine),**

**Musée des Antiquités Nationales
(Saint Germain-en-Laye, Francia)**



Greek writer Philostratus of Lemnos (Rome, 240 BC) witnessed that the Northern Barbarians of the Ocean regions applied colors on hot bronze (Champlevé technique). These populations used enameled buckles, edgings, armors, weapons, jewels and talismans spreading their knowledge during their invasions.

The most ancient enameling in Germany was found in the Rhein region during the Flavian dynasty (69-96 AD).

In Italy, during the 6th century, the Lombards overthrew the Ostrogoths in Ravenna where they learned the technique of Byzantine cloisonné. Italian workshops were appreciated by the 7th century for their perfect enamels spreading across Europe

**Iron Crown, completed in many
phases from the 5th to the 9th
century AD.**

**Byzantine Style Cloisonné from
the Altarpiece of St. Ambrose in
Milan (850, by goldsmith Volvinio)**



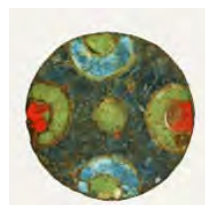
The material's first golden age was in Byzantium (600-1100 AD) where it combined clear shapes with bright colors. The Byzantines preserved the glass technique and the cloisonné enameling. Through the silk route it reached China in the 14th century AD, finding its way into Japan where it seemed already known since the 4th century.

The golden altarpiece in the St. Mark Cathedral in Venice is the masterpiece most of this kind in terms of beauty and dimensions. It had been commissioned around 1000 AD by the Doge Falier and successively, continuously refined until completion during 200 years.

The Germanic lands follow the same evolutionary path between the 8th and 9th century when Byzantine artifacts were introduced.

Around the 10th century, in Central Europe, in Trier and Limoges, copper starts to replace gold. Throughout the Middle Ages a large quantity of reliquaries and religious-themed plates were produced. Copper is carved or engraved, gilded and filled with enamel. This technique is called *champlevé basse-taille* and a mass production of religious objects started.

**Cloisonné technique on iron,
11th century
(found in Haute Vienne)
Musée des Beaux-Arts de
Limoges**



A curious example of iron objects: a religious image and a small coin
Probably meant to be used as money.

During the **12th century AD** schools raised: *Mosane* in Liège and Namur, *Rhenane* in Cologne and *Limousine* in Limoges, and a forth one in Silos, Spain,

Pastoral, champlevé technique, c. 1150 AD
pix and reliquaire, champlevé basse-taille, c. 1200 AD
Treasury of Castello Sforzesco, Milan.



They divulgated cloisonné and later painted enamel techniques. The Limousine school was the first lay workshop. Nicolas de Verdun is a preeminent exponent of the *Rhenane* school, especially known for the Wise Men Reliquary of Cologne (1190-1220) and the Altarpiece of Klosterneuburg (Austria, 1181). Soon after, a new style, the Gothic, developed.



**Reliquary of the Wise Men,
Cologne, Germany, (1190-1220)
by Nicholas de Verdun**

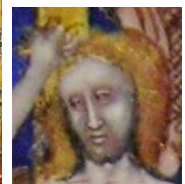


By the **end of the 13th century**, Limoges decays and the shops of Majorca in Spain expands the technique of “**translucent relief**” thanks to some Italian goldsmiths from Siena. The base materials are gold and silver. **Guccio della Mannaia** applied this method during **1288-1292** creating the first artworks of this type: the chalice of Nicolò IV of Assisi. In **1337**, **Ugolino di Vieri**, from Siena, created the large reliquary of the Cathedral of Orvieto. This technique, called “**basse-taille**” (bas-relief) is the evolution of “cloisonné” and “champlevé”; the engravings or chisels on the metal are often filled with enamel. Northern Italy turns from champlevé basse-taille to émail-paint. In the 15th century, Venetian and Lombard enamellers excel for their creations of chalices, plates, pitchers, competing with Limoges.

**Vases, plate,
jug and bowl,
Lombard and
Venetian technique.**



**Pseudo-
Monvaerni,
12x16 cm
(end of the
15th century)**



The transition from champlevé to **émail-paint** happened in Italy and France at the same time. The enameled portrait of J. Fouquet, exhibited at the Louvre Museum, is the first of this kind. He learned this technique from Filarete in Italy in **1454**. Since then, enameling starts to become an art: the plain and stylized figures of cloisonné and champlevé are abandoned and design gets more evidenced. Also the colors progressively get closer to paintings. Its brightness remains and transparency improves on thin gold or silver sheets.

By the end of the 15th century, the works of the **Pseudo-Monvaerni** are made without partitions and carvings on metal.

Following the footsteps of **Nardon Pénicaud**, another French painter **Léonard Limosin (1505-1577)** becomes the first acknowledged enamel artist. He was able to create hundreds of enameled portraits as well as mythological and religious scenes starting from his sketches.

**On the left: Flagellation,
Enamel on Copper,
18x25 cm, presumably by
Léonard Limosin, 1550 AD.**
**On the right: Potrait of the
Palatine Count Jean Philippe,
by Léonard Limosin, 1550 AD**



The **Grisaille** (cameo) technique appears in **1530**: it consists in firing dark enamel on a copper surface covered with white enamel figures, completed with additional bas-relief firings.

Grisaille Technique:

On the left: Jean Laudin.

On the right: Florentine School



In the last 30 years of the **17th century**, this art is fading away as the taste changes and accuracy is lost to mass production.

The “**painting on enamel**” technique is more commercial **and almost an imitation of porcelain**. Miniature sniff boxes and powder compacts prevail together with watch manufacturing and enameled goldsmith artworks. The **guilloché** technique is introduced, it consists of a mechanically worked gold or silver sheet covered by fired layers of transparent enamel. The same technique is used later by **Fabergé** at the end of the 19th century.



On the right, a famous egg of Fabergé.
On the left a match holder and potrait box, Hermitage Museum and Von Stieglitz, St. Petersburg.



The miniatures of the **18th and 19th centuries** are inspired from the paintings of Rubens, Raphael and Tiziano. During the 19th century there is a transition from landscapes to portraits until the introduction of the *daguerreotype*. Industrial enameling starts after **1750**; unfortunately we don't have the time to consider this interesting theme.

During the **20th century**, artists and artistic creations are developed in schools: Burg Giebichenstein, Pforzheim and Hanau in **Germany**, the Massana school by Miguel Soldevila and the Escuela Llotja in **Spain**.

At the end of the century the first International Biennial Exhibition was founded in **France**. “Creative workshops” came-up in Italy led by important artists such as Dal Campo, De Poli, Maretti e Maré, in cooperation with architects and designers such as Gio Ponti and Sottsass.

CONCLUSION OF THE FIRST PART

Over a period of 35 centuries, many enameling techniques have developed, passing through many populations distinguished by culture, religion and social background.

They have been absorbed into and spread by many schools and artistic movements; yet the special fascination for this applied art has overcome every kind of obstacle, reaching our time almost untouched. It remains a difficult art only for an élite of artists who have a passion for amazing results which become visible only after tens of firings at 800°C. A mysterious design of destiny has preserved these techniques and reached us almost unchanged, as the following examples show:



a-Egino Weinert, a-Gertrud Rittman-Fischer, b-Larisa Solomnikova, c-Micaela Doni

a) Cloisonné, with artworks created by the late Egino Weinert from Köln and 90-years old artist Gertrud Rittmann-Fischer who tells enameled stories and poetry.

b) Translucent, and Grisaille hybrid technique, used by Larisa Solomnikova, who creates pieces like jewels.

c) Email paint, the perfection achieved by Bétourné from Limoges or Monna Margarita by Francesc Vilasis-Capalleja from Barcelona; the artistic emotion of the Italian Micaela Doni.



c-Bétourné



c-Francesc Vilasis Capalleja

Let's imagine **Leonardo** using enamels to paint one of his masterpieces, the **Mona Lisa** at the Louvre today, protected due deterioration from time: it would be as if **the Gioconda** were still "new", keeping its original bright colors just extracted from a kiln with the Maestro's expert hands.

ENAMEL AND DESIGN -second part-

Further to the historical overview, let's consider how enamel could gain a winning personality on the market through product design concepts.

An industrial product, for example, an enameled coated gear or chemical reactor (fig. 1) may have exclusively a technical purpose. On the contrary, for other items such knick-knacks, artistic figures or interior decoration objects, the aesthetical attraction is very important (fig. A2,).

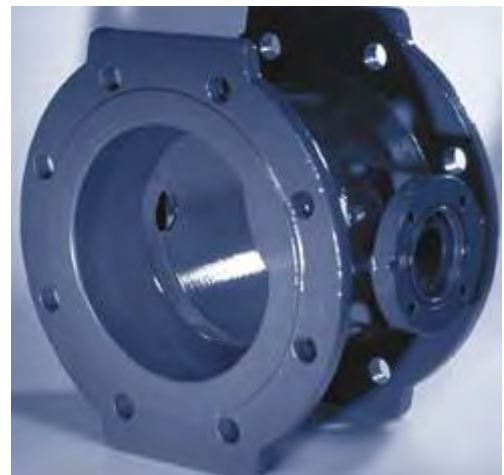
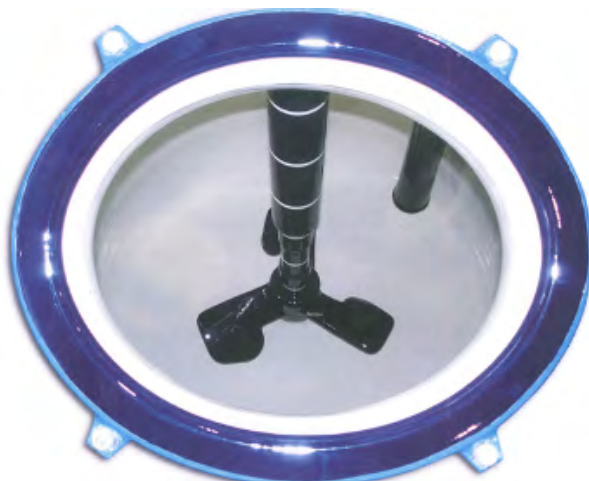


Figure A1: Enamel coated interior wall of chemical reactor (courtesy of 3V Glasscoat). Right: a cast iron enameled body valve.

In fact, for the majority of industrial products technical properties and **aesthetic perception** are equally important.



Figure A2: pheasants and a little dog, enameled with cloisonné technique

In today's saturated markets, the impulse to buy is mainly desire-driven. People tend to buy a product for its aesthetic appeal rather than for its technical and functional characteristics. It is sometimes difficult to admit that in a large part of the products we can find in shops, we tend to be attracted by the aesthetic perception rather than the technical and functional properties of the product.

Consequently, the product image is increasingly important. Buyers charge the product with a meaning, a way to appear, a personality: the product becomes a symbol or way to look at life. Here is the first problem: the technical concept of a product is developed by technicians, engineers, chemists while its appeal or industrial design is ideated by designers and architects. It is not easy to synergize both views which are the base of **"product design"**.

Enameled products are a good example of manufacturers' strictly technical concept separated from designers' imagination of an enameled surface.

Products which are conceived mainly with a technical concept have to compete increasingly on price.

Consequently, some manufacturers moved to "low production costs countries, at the risk to share the same fate of products with low added values.

This downgrading trend should be contrasted by means of innovative additions that shall reinforce the product's personality overcoming its original perception and lead the customer to accept a higher price.

This could be an alternative way, even for enameled products, to avoid the market reduction. Anyway, it's not so easy as it seems.

Unfortunately, many potential customers still associate the enameled product to the obsolete image of the white enamel items of the 50's and 60's, such as kitchen, kitchenware, stoves, bathtubs, etc. It looks like something old, good only for vintage markets.

This material lost its golden period, however preserving its unique technical properties which should be evidenced through different applications.

We must thus change how the product is perceived, conferring to it the idea of modernity, innovation and attractiveness. We will later see how to do that.

According to a product design concept, a product's shape and surface appearance produce an impact when looked at on the street, in advertising, or shop-windows.

Before touching it, we already have a good or negative feeling or idea of the thing.

Therefore, the perception of surface, color, gloss and texture are of primary importance. For example, the “Ferrari red”, the “Mercedes silver” or the “Valentino red” colors played an important part for the brands’ success on the market.

Nevertheless, often for technical design reasons, the materials adopted don’t possess an attractive surface.

Coatings and surface treatments can help to modify a surface’s appearance.

Paints are a powerful method to produce attractive effects.

Of course, coatings allow to achieve the technical performances required by the functionality of the product, such as resistance to corrosion or to mechanical damage.

Enamel coatings were traditionally considered exclusively for their capacity to add technical properties to a surface.

Enamel protects remarkably from corrosion, offers high resistance to mechanical damage, to environmental and atmospheric agents, to high temperatures and fire without releasing toxic substances.



Figura A3: Façades of Kaldewei new development center and the Dexia complex in Luxembourg

Thanks to the development of new frit formulations, production techniques and optimized techniques for enamel deposition on the metal, the material’s properties greatly improved. However, although important, these properties alone are not sufficient to increase the market share and compete successfully with other well known materials, such as painted metal or stainless steel.

The main point consists in strengthening the synergy between technical properties and aesthetic-perceptive aspects. Also in this area, research and technology developed enamel applications with once unthinkable effects and features.

Today color is a very important aspect for products for which color seemed unusual only a few years ago (laptops, cameras, household appliances, furniture components).

Only enameled and varnished coatings are able to offer an almost infinite colors palette. However, in contrast to varnish, enamel has the unique advantage to combine color with the technical property of color resistance during the products entire working life in spite of continuous exposure to UV radiations.

Starting from color, it is possible to change the perception of an enameled surface from cool to warm (fig.5), from white to color and brightness, from high gloss finish to matt. We can modify the object’s perception by changing from a high gloss finish to a matt one (fig.6).



Figure A4: A colored pot set made of enameled cast iron, Invicta SA production (courtesy of Invicta SA). Photos credits Pierre Studio Flament SA



Figure A5: Stoves made of enameled cast iron, Invicta SA production, on the left model Le Ch'ti ivory color, on the right model Seville red color (courtesy of Invicta SA). From white to red color the perception changes. Photos credits: Studio Garnier



Figure A6: enamels of the same color but different gloss.

Particular enamel coating effects will induce the observer to associate them with the intrinsic characteristics of other materials and transfer them unconsciously to the enameled surface. Let's imagine the perfection of stainless steel, the richness of gold, the elegance of brass, the duration of stone. Using enamel layer there are also the opportunities to obtain effects which don't exist in nature (Fig. 7-9).

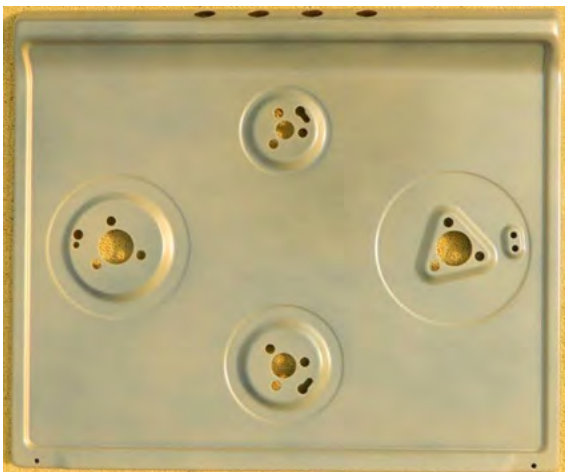


Figure A7: Enameled cooking top with different metallic finishing (gold, copper), giving an exclusive touch to the product, Wendel Email Italia production

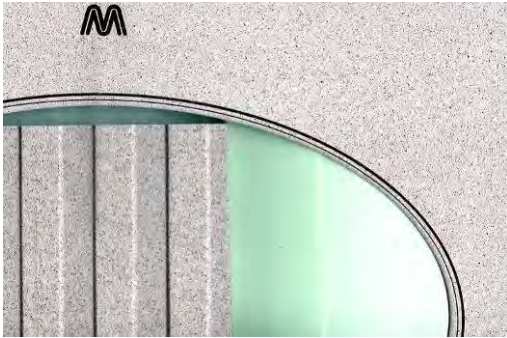
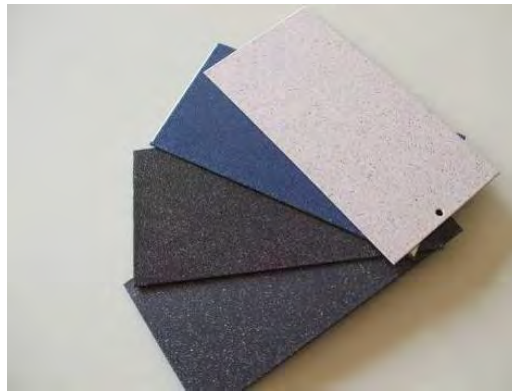


Figure A8: Enamel with granite stone effect



**Figure A9: Enamels with particular effects (on the left and the middle).
On the right: barbecue model One Touch Premium, brown, by WEBER-STEPHEN Co - Palatine, IL (USA) - Fire and rust-proof porcelain-enameled bowl and lid (courtesy of WEBER-STEPHEN)**

Enamels can produce very special surface effects till now unknown to the Designer; such as luminescence (fig.10). These particular applications preserve its optical effect also at high temperature (800°C) and after more thermal cycling in contrast to luminescent paints, inks and organic pigments.

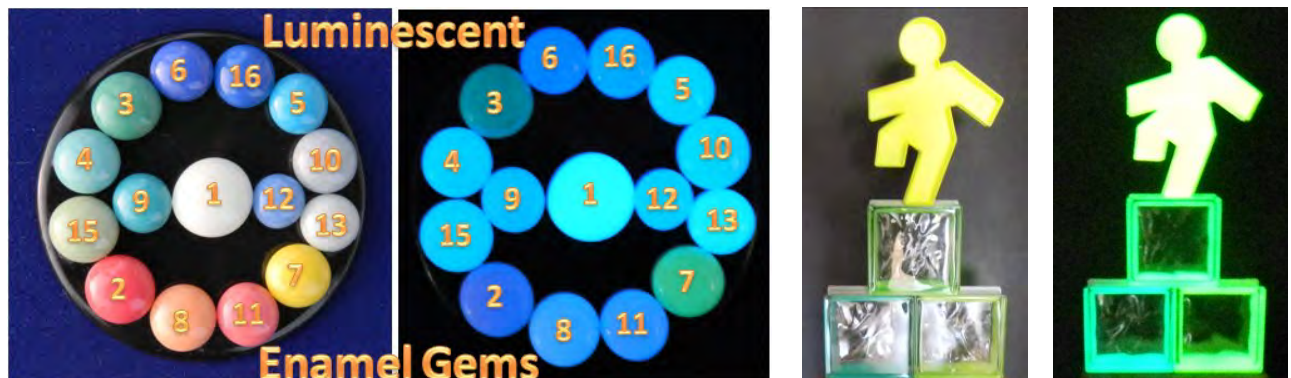


Figure A10: Luminescent enamels exposed to the light (on the left) and in the dark (on the right), Wendel Email Italia production

With the purpose to exploit the potentiality of the new coating possibilities, designers and architects should be involved. A particular surface character adds personality to the technical properties. However, considering the distance of approach between designers and enamel technicians this is still easy talk.



Figure A11: Vitreous Enamel Fire Table by Lee Rowland, 1950 x 420 mm

Luckily, designers are curious, open to experimentation, always searching new ideas and possible solutions in wide fields.

Therefore, not just the strictly technical properties of the enamel should be evidenced but also real examples of successful applications in order to stimulate, through perspective comparison, this type of coating on new products. It's perfect though, to illustrate a number of enamel applications in very different, sometimes distant sectors, to help to perceive its wonderful properties.

Finally, it will be important to emphasize the perfect match between different materials such the combination between enamel and stainless steel or enamel and concrete, or stone (Fig. 11, 12).



Figure A12: Vera Ronnen: Site-specific enamel murals integrated into the landscape and architecture / Skirball Cultural Center, Los Angeles CA, USA / Architect: Moshe Safdie Associate



Figure A13: Auditorium “Academia Barilla”, (Demanicor production) courtesy of Academia Barilla, www.academiabarilla.com: combination between red enamel coating and stainless steel.

Once designers discover and understand the potential of enamel, they can have fun by experimenting color, finish and special effects bound to the unique technical properties of these fantastic layers of enamel.

The book has been written in this spirit.

Acknowledgements

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