

Guide to facade coating

The facade coating characterizes and identifies a building in a very noticeable way if compared to metal fittings. The concept of coating we will deal with is not understood as a repetitive system to cover industrial parallelepipeds: it is rather a versatile building system that can express different esthetical and design conceptions, and that finds its application mainly in the tertiary sector of commercial and public building industry.

In this view, we will offer a methodical panorama of the products and technologies present on the market limiting the attention to the use of aluminium as an architectonic material for facade coatings, passing over both pre-varnished steel coatings – that are still used in the field of industrial buildings – and those in stainless steel, enamelled (glazed) steel and copper.

The motivation of this choice is simple: aluminium, more than any other material, has mimetic and adaptability qualities allowing it to be included in any design context.

The particular nature of the aluminium surface and its particular plasticity allow it

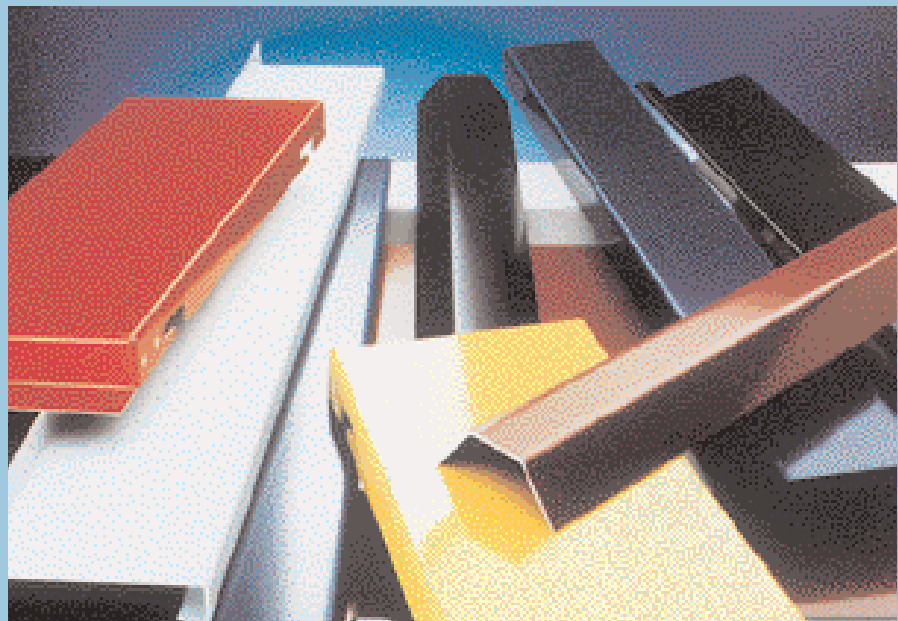
to naturally take on a series of shapes and colours that cannot be compared to any other metal.

Thanks to its mimetic qualities and to the versatility of modern technologies, aluminium always offers solutions perfectly matching with any environment, both in protected urban context – subject to environmental and monumental landscape restrictions – and in restoration or new buildings interventions, as a covering of a high-potential market.

The old town centres represent surely a huge potential market, but most part of

the market is today in the new directional and commercial centres, in the re-building of offices, and also of public buildings in general (airports, schools, universities, supermarkets, hospitals, sports centres, etc.).

The aim is to provide all the tools to evaluate in a competent way the possibilities and limits of the more qualified products offered by the market, and valorising and optimizing their use according to the specific performance and economical requisites.



THE FACADE COATING

The coating can be examined from three points of view:

1. Coating functions
2. Building systems
3. Types of plugging panels

1. Coating functions

For facade coating, we mean a building system external to the primary plugging of the building, with functions of insulating barrier, of optical shield and of esthetical qualification of the building.

Hence, the structural functions have a secondary importance in the facade coating.

The insulating barrier function has to necessarily consider the external elements that influence the coating:

- chemical agents in the atmosphere
- temperature
- water
- air
- noise

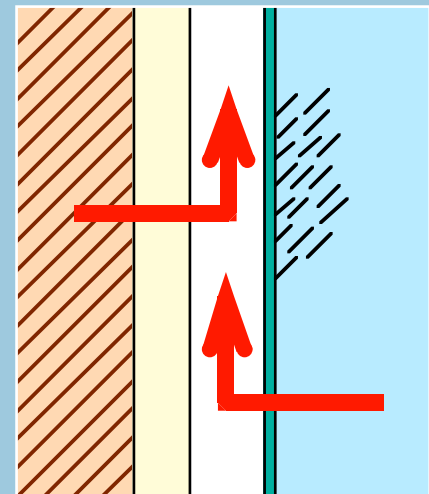
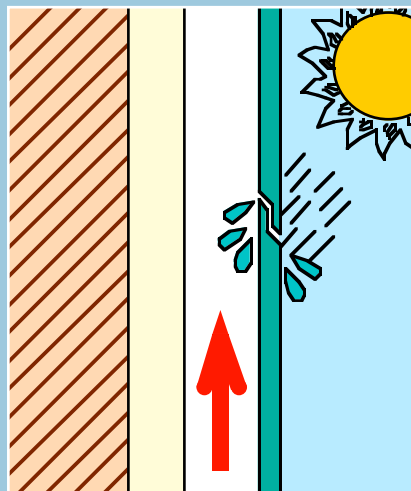
These elements can act also separately on the wall, but it occurs more often that they act simultaneously.

Hence it is necessary to know previously their effect, in order to prevent the deriving consequences.

Among the different atmospheric agents affecting today the facades, acid rains and photo-oxidants are responsible for most part of damages.

Heating and industrial gas wastes produce the sulphuric acids which are contained in acid rains, and they corrode above all metals, reinforced concrete and tender stone (sandstone).

THE ADVANTAGES OF AIRY COATING:
1 - ELIMINATION OF HUMIDITY

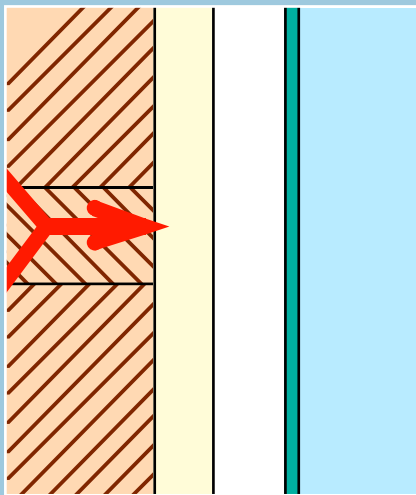


2 - PROTECTION OF THE BUILDING STRUCTURE FROM ATMOSPHERICAL AGENTS

Photo-oxidants are chemical combinations of nitrogen oxide and unburnt hydrocarbons coming above all from car traffic together with ultraviolet rays.

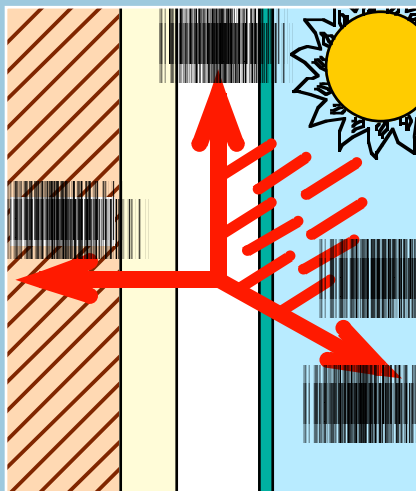
Since photo-oxidants have a remarkable oxidation potential, they quicken the aging of organic materials such as acrylic varnishes and synthetic materials (rubber).

The heating of a coating due to sun irradiation is as stronger as darker is the colour of the facade. At our latitudes, the metallic surfaces finished with dark colours reach 70° C temperatures in very hot days, causing, as a consequence,



3 - ELIMINATION OF THERMAL BRIDGES

4 - SUMMER THERMAL PROTECTION



serious problems linked to the expansion of metallic elements of a coating.

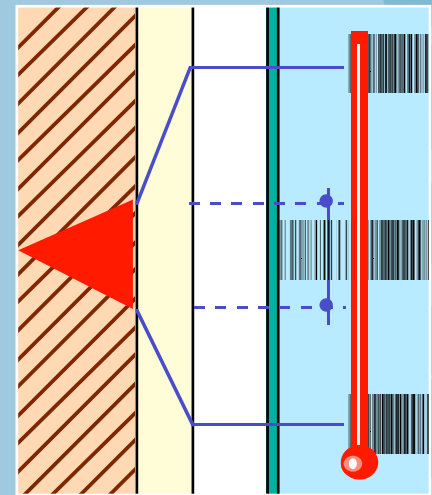
Water is an element that can influence a coating in different ways:

- infiltrations due to rain;
- splits due to water filtered in the closed hollow spaces and then frozen;
- condensation formations on the internal surface of the coating.

The influence of air on a wall coating can be considered from two points of view:

- air as a building element with high thermal insulation properties, both static and dynamic (in windy facades), to be carefully considered in the phase of design of the coating;
- air as wind, whose influence has a central role in the determination of the dimensioning of the coating elements, of anchorages and fixing.

Noise, finally, has not to be undervalued as a disturbance element, due to both the expansion of the coating elements for the thermal gradient, and their vibration under the pressure of wind, and also due



5 - PROTECTION OF THE BUILDING STRUCTURE FROM TEMPERATURE RANGE

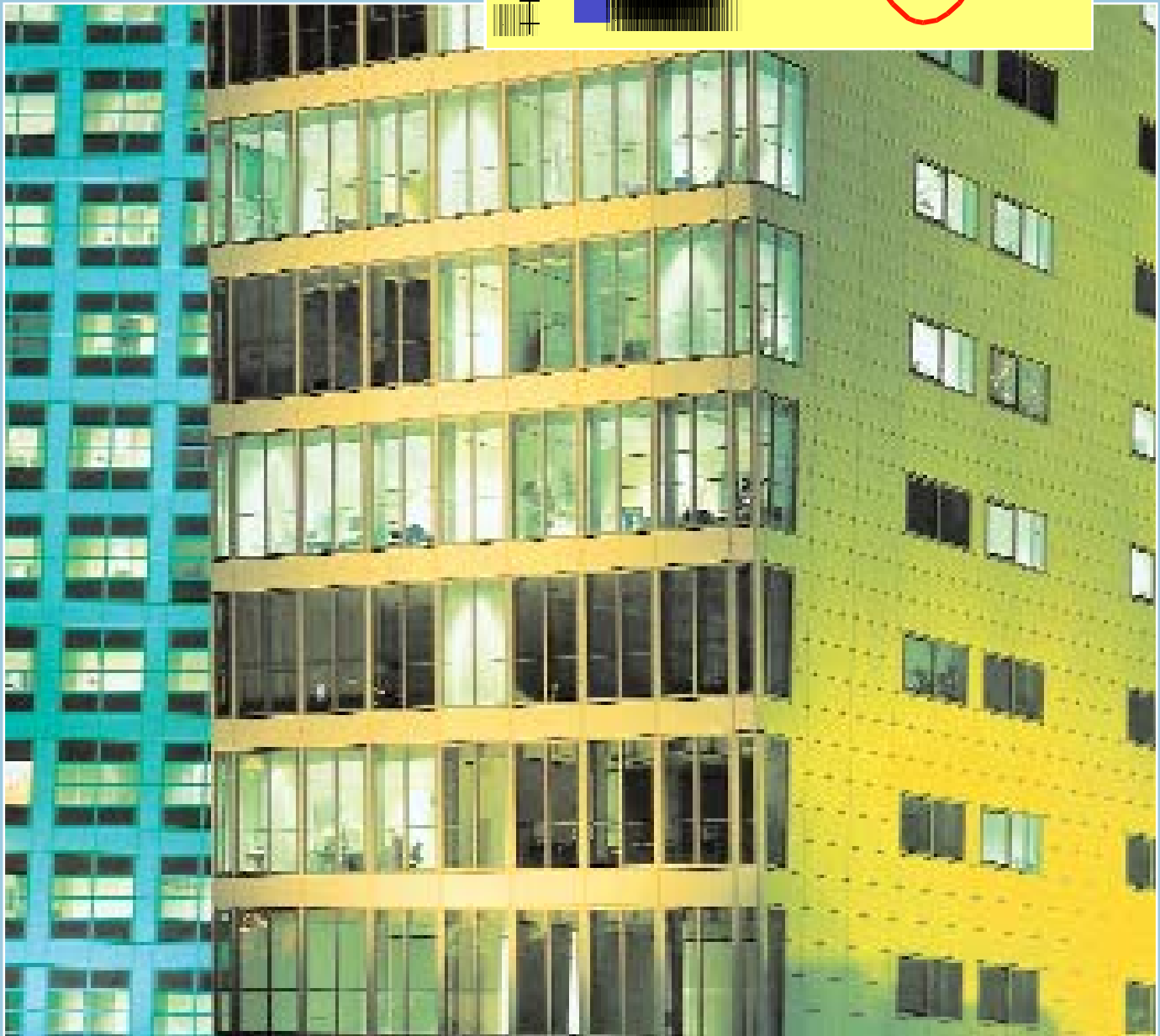
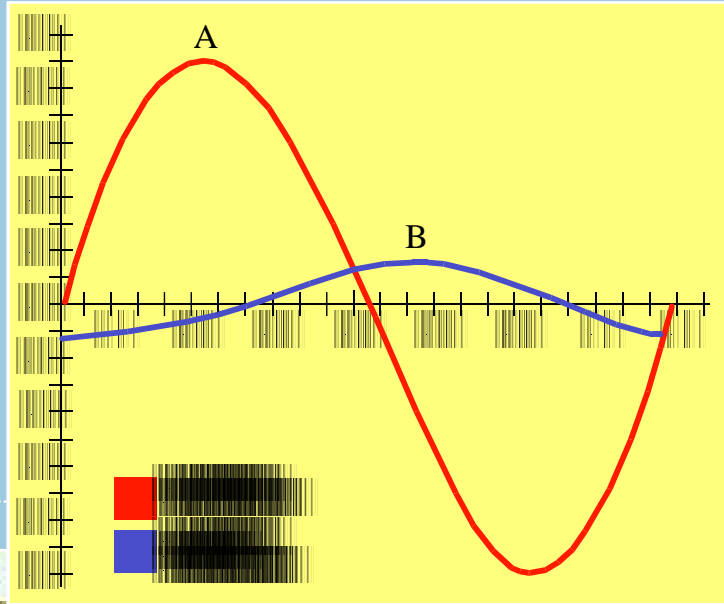
to their sonority in the transmission of mechanical shocks for rain or hail.

2. Building systems

A coating system is essentially formed by three fundamental elements:

- the support substructure;
- the plugging elements, commonly called "panels";
- the anchorage elements of the substructure panels.

PHASE SHIFT AND SOFTENING
OF THERMAL WAVE:
THE COMPARISON BETWEEN A NORMAL WALL
AND AN AIRY FACADE WALL.



A fourth element can intervene, depending on the system:

- holding packing in synthetic material with positioning and control functions of the panels for both the holding of water and air and the closing of the joint for esthetical aims.

According to the building scheme, it is possible to distinguish the following classification:

- **“Shield” coating**
- **“Airy” coating**
- **“Structural” coating**

“Shield” coating

It is generally formed by very thin module staves (not superior to 100 millimetres), shaped with rounded edges and snap fixed with support sleepers in vertical or horizontal direction.

The obtained coat is classified “open”, because it has the only function of optical barrier with essentially aesthetic and architectural aims.



“Airy” coating

We define as “airy” coating a continuous coating mechanically applied to a building structure and at the right distance from it in order to obtain a hollow space of air between the two elements. At the inferior and superior extremity of the coating (or also intermediate, depending on the highness) two continuous openings are placed in order to create an air circulation. The air circulation is due to the normal “draught” produced by the sun provision acting on the facade that, giving away heat to the air present in the hollow

space, causes a natural movement upward due to a pressure difference. This favours the disposal of heat and prevents the transmission by conduction between aluminium and the insulator or the masonry behind.

In the airy wall which is exposed to direct light of the sun, the irradiation heat is mostly reflected by the aluminium coating (until 80% of sun radiations).

Hence, the reflection of a part of energy, the shadow effect on the building structure and above all the natural ventilation, allow, in summer, the dissipation of most part of the energy due to sun provision, with energy conservation equal to almost 20% on the possible conditioning – considered the influence of glass partitions.

In absence of sun radiation, wind, that increases its speed at the increase of distance from the ground, creates a higher pressure upward (assessable, for 10-20 mt buildings, between 0,2 and 1 Pa for each height meter) and so a flow of air descending in the hollow space.

As an integration to this “summer” function, in the winter climatic situation

the insertion of an insulating panel in the airy hollow space contributes in the solution of the problem of heat dissipation towards the outside. As we will see later, this implies a series of advantages compared to the traditional systems of internal insulation. The ventilation of the hollow space has also the main purpose of removing the steam that tran-

spires from the inside of the building. In fact, the elimination of steam in the masonry is the fundamental factor for the complete development of the insulating action on the part of the conducting material, which performs its function in optimal conditions in the airy wall. The acoustic demolition of the airy wall further contributes to the improvement of

the living conditions inside the building. Finally, the advantages offered by the considered system can be summed up as follows:

- Improvement of the thermohygrometric behaviour of the external structure (that implies also the elimination of thermal bridges, of internal and



superficial condensation, an also the increase of thermal inertia, mass being equal).

- Improvement of the internal, summer and winter comfort.
- Reduction of expenses for maintenance and management of the building.
- Urban renewal and restoration.
- Protection of the building structure from atmospheric agents (with subsequent longer duration of the simple structure).
- Easiness of maintenance.

An evolution of the airy wall that is at present studied by the C.S.I. of Bollate (Laboratory of Montepolimeri of the Gruppo Montedison) is the so-called "wall-dynamic" system.

This system, which is inserted into the structure of an airy wall, will be "active", that is, ventilators and air exchangers activate the working.

Among the aims of the wall-dynamic systems, besides allowing air exchanges mechanized and controllable from the inside of the building, there is also the recover of the internal stale air heat to put



it in the hollow space of external air in winter conditions, and vice-versa putting stale air freshened by conditioning in summer situations.

"Structural" coating

Today, almost 20% of commercial buildings is realized with structural facades. The system is largely used also in renewal operations, as simple coating.

Contrary to the airy facade, the coating with structural typology is airtight and does not imply an air circulation at the back.

Hence, it is more suitable for climatic conditions atypical for our Countries, with





mild winter and very hot and humid summer (i.e. the United States) where commercial buildings are mainly conditioned and have fixed glass walls. This kind of coating defines a particular façade system whose panels are joined to the metallic structure making it visible from the outside.

Panels are usually made of glass, but composite aluminium elements can be used, too. The pasting of panels to the support is assured by silicone sealants, which obviously become an integral structural element of the coating, because they must also be simultaneously strong to fix the panels to their place, and quite elastic and flexible to allow the normal expansion movements.

The main advantage of this building technique, in which the coating assumes the role of “barrier to steam” from the outside to the inside of the building, is to allow the thermo-hygrometric improvement of the building structure in climatic conditions that imply a steam pressure from the outside to the inside of the building. Moreover, in any latitude this kind of coating is used, there are above all aesthetical advantages.

The structural façade allows very smooth architectural solutions, without optical interruptions, with perfectly sharp plain or curved paintings of the glass surfaces, with striking light and surface effects.

However, near the aesthetical and thermal advantages, the structural coating offers a good acoustic insulation, and also an optimal softening of vibrations between the external and the internal environment. From a building point of view, it is absolutely advisable the realization in the workshop, by using silicone, of the matching of the panel with the substructure frame.

In fact, structural silica must be used on surfaces without traces of grease



and powder and perfectly dry. Moreover, it is very important that the aluminium surface in contact with silicone is passivated and without oxides. Hence, it will have to be protected with a pre-painting (above all polyester) or with a chromium-plating.