

POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

PUrAL: production and testing of a wrapping element through the recovery of aluminium waste

by Matteo Bertola

Tutor: Jean Marc Tulliani

Co-tutor: Roberto Giordano

This research comes from the cooperation between a company which works in Turin in the doors and windows field and makes its products mostly in aluminium, and the Polytechnic Institute of Turin, in particular with the DINSE (Science and Technique of the Settlement Processes Department) and the DISMIC (Materials Science Department). This cooperation comes from the company's will to recycle its most important waste material, i.e. aluminium burrs. Such waste cannot be recycled in the place where it is produced, so it is thrown away, representing an additional cost for the company which has to deal with its disposal.

As far as recycling is concerned, aluminium chips, once they are separated from potential foreign materials, can be completely recovered. They are not subjected to degradations in their properties and do not cause either waste or unusable chips. Furthermore, its recovery and recycling allows us to save an appreciable amount of the energy required, in order to produce aluminium starting from the raw material.

MAIN TARGET

First, we tried to understand which potentialities the examined material could offer and, most of all, how it could be reused in the building trade. Then, the first step has been that of understanding where aluminium could be enclosed: the effects we wanted to obtain were not only aesthetic, but it was also necessary that the waste helped to improve the performance features of the finished product.

SPECIFIC TARGETS

- First, we chose to mix aluminium with different types of resins which could give the final material a kind of compactness and consistency in order to be able to use this tile either as outer layer of a ventilated wall or as indoor floor.

- Then, after rejecting the second option, we chose to make a panel (made of resin and aluminium) of this size (about 20 x 20 cm) and to decide, through laboratory tests, whether the material was suitable as outer layer of a ventilated wall. To do that, the requirements provided by the law (UNI EN 438:2005), have been the most important normative reference.

According to the project targets, the research activity has been structured through the following stages:

- **First stage:** identification of the normative requirements (CE marking) and marketing research of the specific polymeric material which could fulfil the expected requirements. The features required were the following:

- The resin could not absolutely turn yellow if exposed to the UV rays, it had to resist to the freeze/thaw cycle, to the humidity and to the rains full of acids and pollutants.
- The resin had to be transparent in order to keep the aesthetic aspect of the finished product.

The search of the resin which could fulfil those requirements has not been easy at all. Before finding the right one on the market, we created several samples with different kinds of resins. In particular, two acrylic resins in a watery emulsion (Primal AC-339 of the Rohm & Haas and Atomo of the San Marco), an epoxy resin (Epojet of the Mapei) and a polyurethane transparent resin (PU026) of the Poolkemie;

- **Second stage:** finished product testing in the laboratory of the Materials Science Department (DISMIC) and check of the normative requirements established by the UNI law with reference to the CE marking.
- **Third stage:** first studies and evaluations of the product in order to make it environmentally-friendly.



In conclusion, the final results have been very satisfactory and fulfil the expected targets: bending tests and impact resistance tests have provided very interesting data, beyond all the expectations; the moisture testing has proved that the samples do not tend to absorb water in their mass and the UV test has proved that the samples are not sensitive to the ultraviolet radiations.

To sum up, this thesis work has been an experience in the field of recycled products testing and represents a potential “challenge” which we hope indeed will be taken into consideration by companies and research institutes.



For further information, e-mail:
Matteo Bertola: matteo.bertola@libero.it