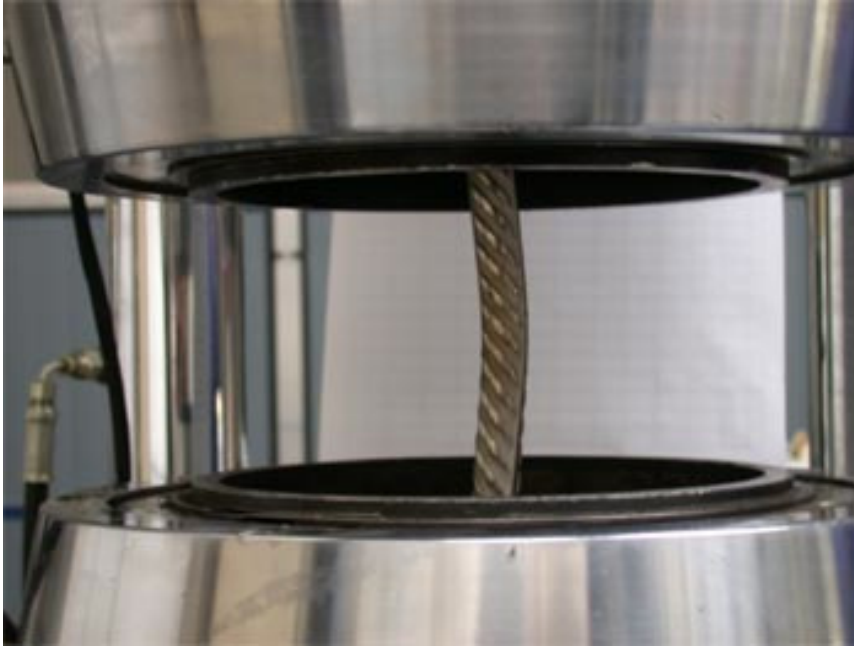


WEAR RESISTANCE

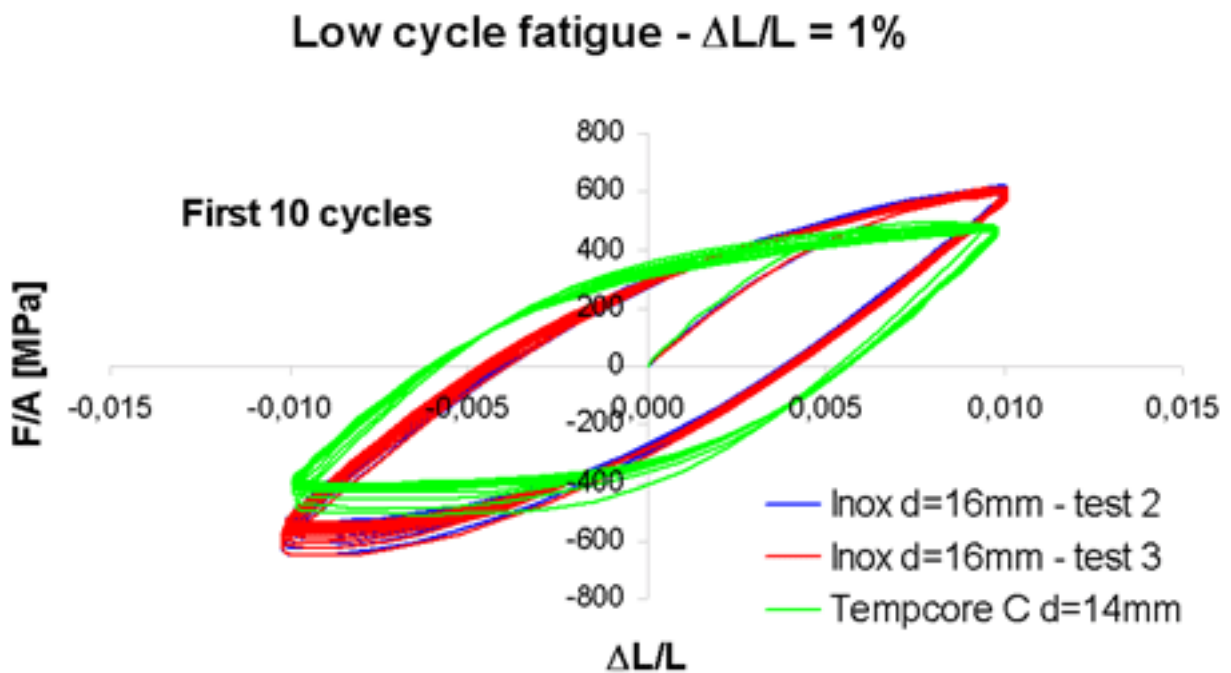
Low cycle fatigue tests have been carried out at Politecnico in Milano (Department of Structural Engineering).

Test pieces have been used with a distance between the grips equal to ten times the diameter and imposing a shift from the machine heads $\Delta l = 0.01$ times the distance between the grips.

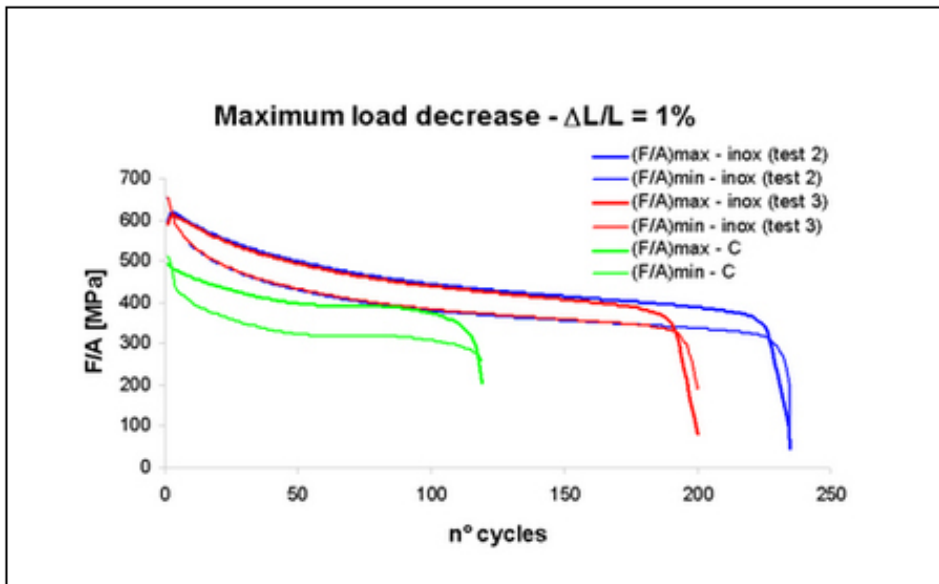


Picture 8 - Low cycle Fatigue tests.

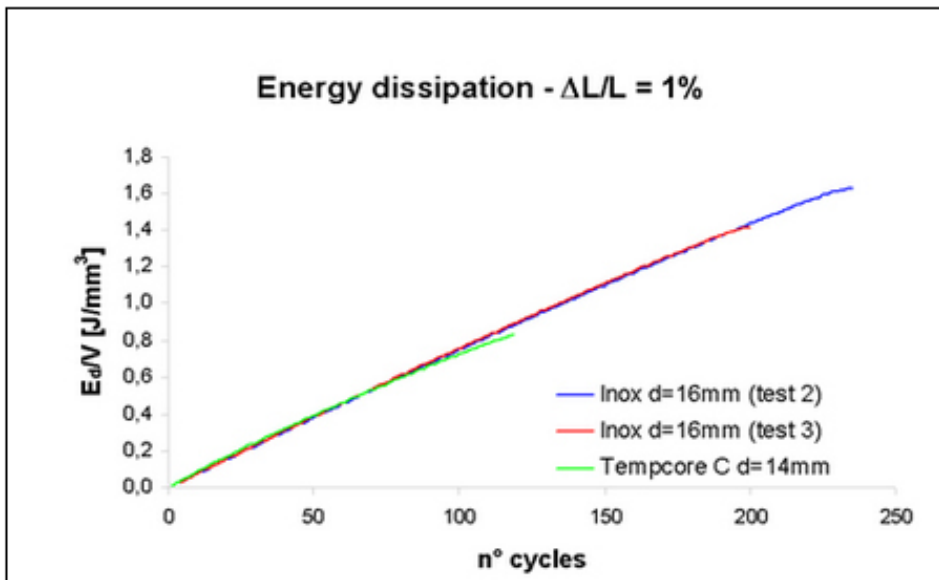
The results obtained on those test pieces are reported below.



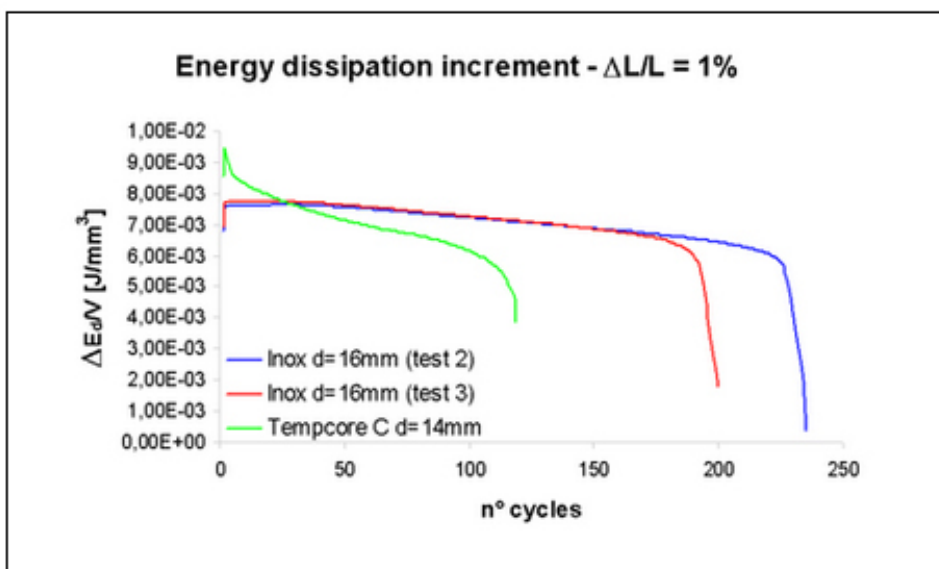
Picture 8 a - Low cycle fatigue



Picture 8 b - Maximum load decrease



Picture 8 c - Energy dissipation



Picture 8 d - Energy dissipation increment

The superiority of stainless steel compared to carbon steel is obvious in terms of ductility.

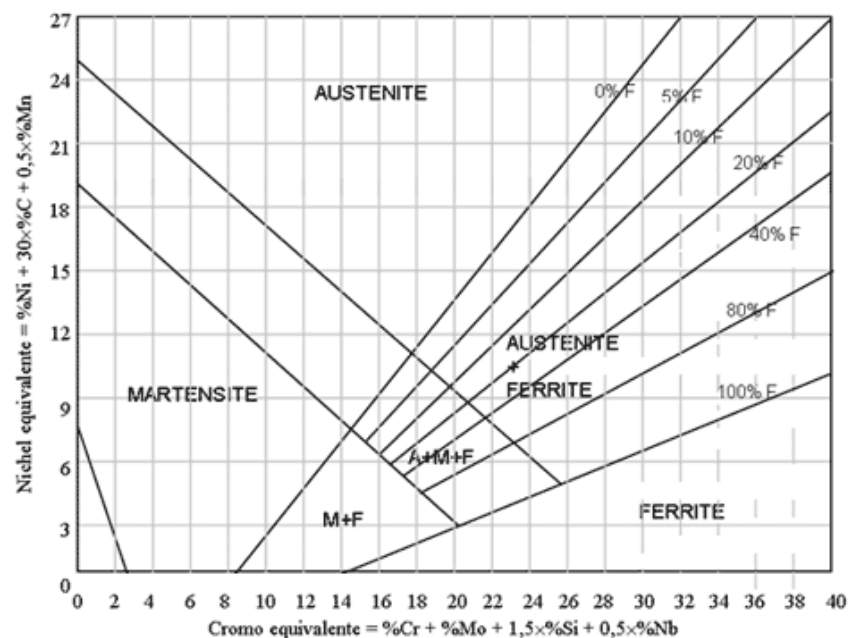
WELDABILITY

Stainless steel weldability mainly depends on its chemical composition. For instance it improves by reducing carbon content and increasing Nickel content.

The techniques mainly used are resistance and arc welding. Resistance welding has the least thermic impact, which has very little effect on stainless steel structure and properties. Anyway it is advisable to take the appropriate precautions as for instance, to carry out welding in closed and protected areas, not operating in open yards where atmospheric conditions or simply environmental conditions (dust) can seriously alter the results. Otherwise welding of austenitic stainless steels presents no problem. In fact no pre-heat or post welding heat treatments are required. However due to their low thermal conductivity and rather high expansion factors, distortions can result or residual tensions can accumulate after welding.

Those are usually absorbed by austenite that has a good capacity for deformation and a little notch sensitivity. Many studies have been carried out on the effects that welding can have on corrosion resistance. Generally the welded area always shows a slight oxide layer. That reduces corrosion resistance by pitting. That is why it is advisable to remove that layer as much as possible. A simple application with brushes or a cloth does not generally give results sufficiently good whereas the use of pickling pastes with acid content thoroughly removes the oxide layer for a depth of 1-3 microns and so greatly reduces the probabilities of chemical attack on stainless steel rebars.

As far as welding between stainless and carbon steel is concerned, the dilution effect of the alloying elements in stainless steel, due to their diffusion towards C steel, has to be taken into account. Consulting a Schaeffler diagram is very useful to check the possibility of generating mixed structures in the weld area between different metals (drawing 9). The Schaeffler diagram shows the structures that can be obtained, according to the chemical composition.: it is expressed by means of Cr equivalent and Ni equivalent that represent ferritizing and austenitizing elements.



Picture 9 - Schaeffler diagram

Examination of the diagram shows the complexity of the structural problems and the ease with which structures can appear according to the welding bath analysis. If knowing in advance the possible structures that could appear in the rib, it will be possible to make the correct choice of weld material in order to obtain a precise chemical composition and final structure and so avoid stages that could alter corrosion resistance or mechanical resistance of the joint.

That is why we advise the use of welds with appropriate electrodes (generally stainless steels with high chromium and nickel contents) able to give the welded area at least the chemical composition of an AISI 304.

MAGNETIC PROPERTIES

Stainless steels magnetic permeability varies according to steel grade; austenitic stainless steels are generally considered non magnetic or slightly magnetic according to the residual work hardening from the production process.

The relative magnetic permeability decreases according to the following scale.

1.4301 > 1.4436 > 1.4529
(304L > 316L > 354/1)

Austenitic-ferritic stainless steels on the contrary have obvious magnetic properties according to ferrite content in their structure.