

ABSTRACT

Lately, due to the high cost of repairing concrete structures with steel on the effect of corrosion, designers have become aware of the need for new substitutes of corrugated steel bars. These materials must ensure the safety and the service, aesthetic and functional conditions of the structure during the lifetime it was designed for.

Searching for new materials to replace the corrugated steel bars, carbon fiber reinforced polymer bars (CFRP) appear a few years ago. This type of material is lighter than steel bars. Additionally, it has a tensile strength greater than steel bars and also solves the problem of corrosion.

One of the most important parameters in the design of a structure is checking the bond to the concrete in any thermal conditions. As a result, before introducing this new type of bar it is compulsory to test it. In addition, it is one of the assumptions on which the current design standards of reinforced concrete structures are based.

This thesis analyses the bond behavior between CFRP bars and concrete in different thermal conditions. Consequently, a campaign of 175 pullout test is studied. These tests are performed under thermal conditions Freeze/Thawn, 5 ° C, 20 ° C, 40 ° C and 80 ° C , both CFRP bars with sandblasted surface treatment, textured and corrugated, like corrugated steel bars. Prior to carrying out the pullout experimental tests, 21 equivalent diameter tests and 21 longitudinal tensile tests are made in in both types of bars. Furthermore, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC) and microhardness complementary test are performed in CFRP bars. Simultaneously,

images of pullout test with optic microscopy, scanning electron microscopy (SEM) and atomic force microscopy (AFM) are obtained.

Concluding, different surface treatments of CFRP bars are not standardized, unlike steel bars. They mobilize bond different adhesive mechanisms and modify the behavior of CFRP bars. Being among them the corrugated treatment in CFRP bars, only that produces a similar bond than corrugated steel bars. Moreover, it is found that the thermal conditions differentially affect the different types of CFRP bars.