ABSTRACT
The fork suspension’s steerer tube in a bicycle is a component of great importance considering that dynamic loading during operation may cause accident to the rider. This component is manufactured by machining processes from aluminum alloy 6013-T6 extrusion tubular profile. The objective of the present paper is to study the effect of different shot peening conditions on the fatigue behavior of the material and, as a consequence, increases in the useful life/safety of the structure. Experimental results showed that thread forming by manufacturing process increased the fatigue strength of the aluminum alloy, in comparison to the manufacturing process through conventional machining.

Keywords: Bicycle, residual stresses, steerer, fork suspension.

INTRODUCTION
Fatigue is a progressive and permanent structural change that occurs in components subjected to variations in stresses and deformations that can, as a consequence, result in failures or fractures after an enough number of cycles (Nascimento, 2014). The fatigue fracture process, which consists in crack nucleation and propagation, usually arises at the surface of the structure considering the presence of maximum stresses and deformations. In special cases subsurface nucleation may be associated to internal defects or superficial hardening. Most of the fractures are caused by fatigue as a result of inadequate projects involving stress concentrations or defects produced during manufacture or maintenance operations. Shot peening is the most used process to create compressive surface residual stresses that have a significant influence on the fatigue strength of engineering components (Costa, 2009; Bonora, 2014; Wohlfahrt, 2014). The increase in fatigue life is associated to the ability of the compressive residual stresses in stopping the microcrack propagation and/or retard nucleation.

The objective of this research is to evaluate the effect of different shot peening conditions on the axial fatigue strength of aluminum alloy 6013-T6, used in the fork suspension’s steerer tube, an important structural bicycle component. To test the tubular profile specimen with the geometry based on the steerer tube dimension, a specific testing methodology was developed. Experimental results showed that thread forming by manufacturing process increased the fatigue strength of the aluminum alloy, in comparison to the manufacturing process through conventional machining. The effect of stress concentration and surface defects is extremely detrimental to the fatigue life of the aluminum alloy.

RESULTS AND DISCUSSION
Axial SxN fatigue curves are represented in figure 1A, for base material and six shot peening conditions.
In figure 1B the residual stresses profile are indicated for the shot peening using steel and glass shots.

Effects of stress concentration like machined threads and surface defects are extremely detrimental to the fatigue strength of aluminum alloy Al 6013-T6. The shot peening process induced significant compressive residual stress, but decreased the fatigue life of Al 6013-T6 in tubular profile. This effect was strengthened with higher Almen intensities. The fatigue strength only increased in specimens that were polished on the inner surface. Shot peening using glass shots and intermediate Almen intensity showed higher fatigue life.

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