



Tecnura

ISSN: 0123-921X

ISSN: 2248-7638

Universidad Distrital Francisco José de Caldas

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EDITORIAL

Tecnura, vol. 23, núm. 61, 2019, Julio-Septiembre, p. 10
Universidad Distrital Francisco José de Caldas

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One of the most required and used materials in construction is steel. China leads steel production in the world (with a 50% share of the global market), followed by the European Union, and India. In Latin America, Colombia is the fourth country that produces metals and the sixth that produces iron and steel. This sector represents 0.7% of the country's total GDP, generating 40,000 direct and indirect jobs. According to the latest annual Manufacturing Survey of 2016, steelmakers represent 0.8% of direct and indirect jobs in the country, representing about 6.6% of the GDP of Colombia's industrial sector. To promote local steel production, Colombia has increased tariffs to about 30% since 2011, affecting the price of products made of metals. Additionally, the metallurgical sector has registered a negative behavior in recent years, so that the GDP of basic metallurgical products registered the worst performance among the industrial subsectors with 10.4% in 2017 (well below the fall of 1 % of industry and growth of 1.8% of total GDP), while the production of fabricated metal articles registered positive growth.

On the other hand, despite continuing to be suitable for the construction of machine components and structural elements, it is important to keep in mind that metal materials have presented significant breaks throughout history, including some caused by fatigue processes. This inevitably produces high cost overruns due to abrupt or unpredictable damage to

mechanical elements or, in the worst case, human losses. Therefore, the application and development of new Fe-Mn-Al-C alloys is a technological challenge that requires the characterization of its mechanical and microstructural properties so that designers of structures, devices and machines can consider it as a reliable material that can be specified for your designs. On an industrial level, it is known that much of the premature failures of machine or structure components are caused by the fatigue phenomenon. Additionally, the elements of structures and machines require longer periods of life under conditions of cyclic loading (fatigue), which has led to great research efforts worldwide to obtain materials with excellent combination of mechanical properties; however, conventional fatigue tests require expensive test bodies and prolonged tests over time.

The metalworking and construction sectors could be strengthened with the contribution in research and development by the academy if part of the 70 thousand tons per year of steels that are imported today were produced in the country. In this way, value would be added to non-renewable resources such as Iron, Manganese, Aluminum, and Carbon (which are currently exported as commodities and extracted in Colombia as raw material at a low cost) and would be used in these new alloys. This would contribute to strengthening strategic sectors and increasing the country's competitiveness.

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