Tamara Aleksandrov Fabijanic et al., J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C8-113

The influence of Nb content on the mechanical properties of micro alloyed low carbon steels

Tamara Aleksandrov Fabijanic, Tin Brlic, Ivan Jandrlić, Mladen Franz, Željko Alar and **Stoja Reskovic**
University of Zagreb, Croatia

Niobium Nb micro alloyed low carbon steel contains small amounts of Nb as an alloying element (0.02-0.1 wt%), which has a significant impact on many material properties. Niobium shows a strong affinity for nitrogen and carbon and causes the formation of niobium carbide and niobium nitride within the structure of the steel which improve the grain refining, retardation of recrystallization, and precipitation hardening [1-5]. Those precipitates are dispersed in the form of small Nb (CN) precipitates, which are arranged in fine lines [1, 4]. Consequently, the toughness, yield point and ultimate tensile strength, formability, and weldability of the micro alloyed steel are increased with small decrease in elongation and ductility [1-5]. The mechanical properties of Nb micro alloyed low carbon steel were researched in the paper. For the purpose of research the low alloyed steels with different Nb content; 0.035 wt. %Nb and 0.06 wt. %Nb were selected. The tensile test with the combination of digital image correlation (DIC) and thermography were used to study the thermomechanical behaviour of materials. The test pieces were cut from the hot rolling strip which were air cooled and thermomechanically treated. The test pieces of low carbon steel were tested for the comparison. The test pieces with the original gauge length L0 of 45 mm, original width b0 of 20 mm were prepared. The tensile test was performed in accordance with ISO 6892-1:2009 at room temperature. Two different strain rates; 5mm/min and 20 mm/min were applied in order to research the potential of Nb micro alloyed low carbon steels for improved energy absorption. The highest values of yield strength and tensile strength and the lowest values of elongation were measured for the test pieces with 0.06 wt. %Nb. The strength measured at different strain rates did not change for both Nb micro alloyed steels and low carbon steel indicating that materials do not show positive strain rate sensitivity.

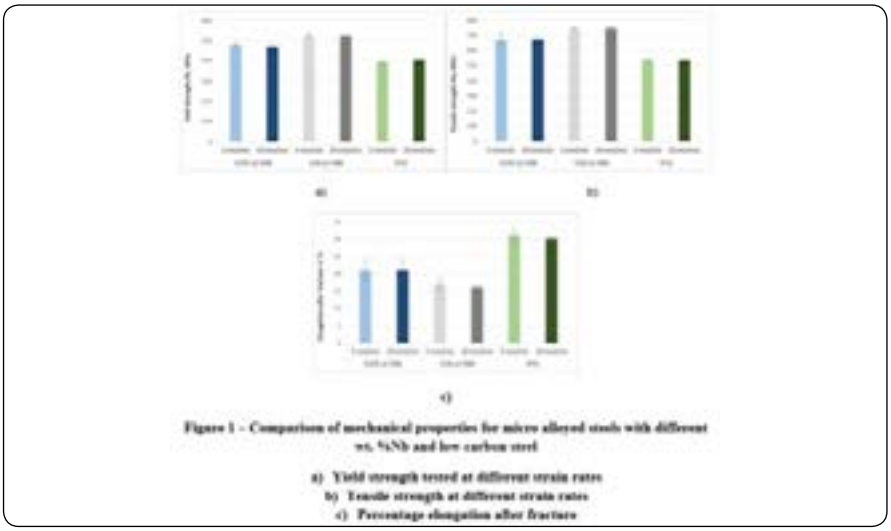

Figure 1 - Comparison of mechanical properties for micro alloyed steels with different wt. %Nb and low carbon steel

a) Yield strength tested at different strain rates
b) Tensile strength at different strain rates
c) Percentage elongation after fracture

Recent Publications:

1. Jandrlić, Ivan; Rešković, Stoja; Brlić, Tin: Distribution of stress in deformation zone of niobium microalloyed steel, Metals and materials international, 2018; 1-6
2. S. Shanmugama, N.K. Ramisetti, R.D.K. Misra , T. Mannering, D. Panda, S. Jansto: Effect of cooling rate on the microstructure and mechanical properties of Nb-microalloyed steels, Materials Science and Engineering A, 460–461 (2007) 335–343

3. D. Bhattacharya, Microalloyed steels for the automotive industry. Tecnologia em Metalurgia, Materiais e Mineração 11(4), 371–383 (2014)
4. M.I. Equbal, P. Talukdar, V. Kumar, R.K. Ohdar, Deformation behavior of micro-alloyed steel by using thermo mechanical simulator and finite element method. Proc. Mater. Sci. 6, 674–681 (2014)
5. W.B. Morrison, Overview of microalloying in steel, in The Proceedings of the Vanitec Symposium, Guilin, China 2000, The Vanadium International Technical Committee (Vanitec Limited, Westerham Kent, England, 2000), pp. 25–35

Biography

Tamara Aleksandrov Fabijanic is employed as a research assistant at the Laboratory for the Mechanical Properties of the Faculty of Mechanical Engineering and Naval Architecture. She gained PhD in 2014 by defending her dissertation titled "Development of Reference Vickers Hardness Blocks by Powder Metallurgy Process". In addition to teaching and scientific work in the field of materials, she also participates in the field of testing and calibration of force and hardness and testing of mechanical properties. In the area of scientific metrology as an employee of the Laboratory for Testing Mechanical Properties, a national standard for force and hardness, intensively cooperates with the most prestigious European institutes through various interlaboratory comparisons of force and hardness measurements. She has been trained scientifically and professionally in Croatia and abroad, the most important being Physikalische Technische Bundesanstalt, Braunschweig and Fraunhoffer IIKTS, Dresden.

tamara.aleksandrov@fsb.hr

Notes:

This work has been fully supported by the Croatian Science Foundation under the Project Number IP-2016-06-1270