Overall Data	
Title	Surface integrity evolution of microalloyed steels along the gear manufacturing chain
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Area	Manufacturing & Processing; Materials

Abstract

The increasing demand for high performance gears for electric mobility requires in-depth investigations of advanced materials. In this respect, microalloyed steels may appear as an alternative with technical and economic potential. Microalloyed steels may exhibit a more refined grain structure than conventional steels, which is commonly induced by the precipitation of highly stable and dispersed second-phase particles. However, the low comprehension concerning the behavior of microalloyed steels along the gear manufacturing chain does not reflect the benefits that these new alloys may offer. This investigation aimed at understanding how the steel grain structure obtained by the addition of niobium (Nb) and titanium (Ti) as microalloying elements correlates to the material surface integrity promoted by a conventional gear manufacturing chain. The results herein obtained show that the addition of microalloying elements induces a microstructure with refined grain structure after the processes with thermal loading. The benefits of the new alloys are observed in the residual stress state and in the topography, in which they present higher levels of compressive residual stress combined with a surface with reduced roughness. The results also indicate a reduction in the teeth distortion levels associated with homogeneous grain structure, such as that obtained with the combined addition of Nb and Ti. Such characteristics place the microalloyed steels in a prominent position regarding their application in the gear manufacturing, indicating the possibility of both fatigue lifetime and NVH emission improvement. By the comprehension of how the final surface integrity state is reflected in fatigue lifetime improvement, downsizing-oriented gear designs can be developed.