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Optimization of Fe-Mn-Al-C low-density steels for forging application

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In the present paper the preliminary results of RFCS-funded LIGHTFORGE project, focused on the Fe-C-Mn-Al low-density steels, are discussed. The decarbonization of the automotive sector is a key goal to limit the greenhouse effect emissions and attain the Paris Agreement objectives and the reduction of energy consumption is together with improving safety standards paramount in modern transportation. To fulfil these objectives the development of strong, tough, and ductile steels for automotive applications is an essential part in steel research.. Low density Fe–Mn–Al–C steels steels may achieve a 15% diminution of steel density depending on the aluminum content and are promising candidates for structural forged parts owing to their capability to contribute in reducing the vehicle weight mainly achieved through alloying with aluminium (Al) (~1.3% density reduction per 1 wt.% Al). At the RFCS-funded LIGHTFORGE project, research has been focused on the design and selection of the Fe-C-Mn-Al low-density steels suitable for semi-industrial forging trials of massive components. The design of low-density steels was assisted by MatCalc and JMatPro software to select the chemical compositions of laboratory medium-scale ingots. Casting and hot forging/rolling processes were optimized by a sort of trial and error to overcome unexpected obstacles. The characterization of the microstructure by OM, SEM and synchrotron and the evaluation of its hot ductility allowed estimating the most important features to improve steel processability.

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