Influence of tempering on the mechanical properties of micro-alloyed (Ti, B, Nb) medium-manganese forging steels for automotive application.

In this study the influence of different tempering temperatures on the mechanical properties and the microstructure was investigated. Different steel-concepts have been compared.

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ABSTRACT:

Classic tempering steels like 42CrMo4 are widely chosen as a material for forged safety components with different cross sections. In the past, it has been shown that the fatigue life of these components can be increased, while reducing the development and manufacturing costs, if new material concepts are used.

With microalloyed medium-Mn steels the above mentioned goals can be fulfilled. However, compared to the classic tempering steels these materials have decreased toughness values. In order to optimize the mechanical properties tempering treatments have been applied to two laboratory melts (LHD-9 and LHD2-L1).

The microstructure and elemental distribution was characterized by LOM (light optical microscopy), SEM (scanning electron microscopy) and EDX (energy dispersive X-ray spectroscopy). The mechanical behavior of the different materials was tested by tensile and notch impact tests.

The impact toughness shows a significant growth after a tempering at 650 °C for 2 h. The SEM figures of the fractures are showing a second phase on the prior austenite grain-boundaries which have an increased content of manganese and carbon than the matrix. These second phase on the grain boundary is expected to be responsible for the increase of the impact toughness.