Influence of Carbon Content on Toughness of Microalloyed Direct-Heat-Treated Steels

The hardness and mechanical strength of ferrite-pearlite DHT steels increase with increasing carbon or carbon-equivalent alloy elements.

However, their impact toughness decreases as strength and hardness increase.

Therefore, lower carbon contents are favorable for the improvement of impact toughness, and additional measures to strengthen ferrite crystal structures have been investigated. Compared with simple vanadium-alloyed steel, low-carbon and manganese-microalloyed steels have much higher impact toughness, comparable to that of traditional quenched and tempered steels, as shown in the graph.

The graph shows the influence of carbon content on mechanical properties of DHT steels. Forging temperature: 1523 K; finish temperature: 1323 K. QT, quenched and tempered.