ALCAR® MULTICOMPONENT FE- AND NI-BASESILICON-FREE MASTER ALLOYS

These multicomponent silicon-free master alloys are used to produce ingots of heat resistant and low-silicon steels.

1. **ALCAR®Fe** multicomponent silicon-free master alloys are used to treat carbon, low-, medium- and high-alloy steels and alloys.

2. **ALCAR®Ni** multicomponent silicon-free master alloys are used to treat low-, medium- and high-alloy steels and alloys.

Fe- and Ni-based master alloys contain such elements **Ca, Al, Nb (niobium), Ti, B (boron), V (vanadium) and REM.**

Nickel imparts corrosion resistance, high strength and ductility to steel, increases its hardenability, and makes an impact on the coefficient of thermal expansion.

Vanadium increases the hardness and strength of steel and contributes to grain refinement. It also increases the density of steel because it is an efficient deoxidizer.

The influence of vanadium in low-alloy steels is determined, to a considerable degree, by their carbonitride strengthening including:
- dispersion strengthening
- grain refinement
- formation of the perfect grain microstructure

Vanadium carbonitrides serve as nucleating centers when new austenite grains are formed during the process of heating above critical points and promote formation of more refined austenite grains.

Niobium is a strong carbide forming element. It slightly lowers the value of impact strength but induces a significant decrease in the ductile-to-brittle transition temperature evaluated on the basis of a ductile constituent percentage in the fracture of impact-test specimens. As compared to vanadium, niobium is more efficient carbide for thermally strengthened steels. It influences more significantly the stability of austenite by means of suppressing the processes of ferrite formation.

A niobium addition promotes significant refinement of the structure and increases stability against austenite grain growth. It improves the quality of steels in three ways:
- by refining austenite and ferrite grains and impeding the recrystallization and growth of grains
- by suppressing the nucleation of polygonal ferrite as a result of increased hardenability
- by increasing the strength due to separation of niobium carbonitrides during the process of cooling of steel or subsequent aging

Boron microalloying is used:
- when producing carbon steels: for increasing hardenability
- when producing low-alloy steels: for reducing to a lesser extent their alloying by using expensive and critical elements (molybdenum, nickel) without compromising their mechanical and performance properties. Concurrently, such operational characteristics they have as cuttability, weldability and cold working property improve