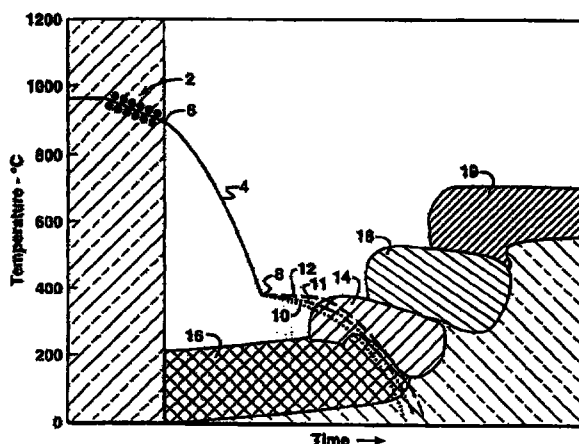




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(54) Title: **ULTRA-HIGH STRENGTH AUSAGED STEELS WITH EXCELLENT CRYOGENIC TEMPERATURE TOUGHNESS**

(57) Abstract

An ultra-high strength, weldable, low alloy steel with excellent cryogenic temperature toughness in the base plate and in the heat affected zone (HAZ) when welded, having a tensile strength greater than about 830 MPa (120 ksi) and a microstructure comprising (i) predominantly fine-grained lower bainite, fine-grained lath martensite, fine granular bainite (FGB), or mixtures thereof, and (ii) up to about 10 vol % retained austenite, is prepared by heating a steel slab comprising iron and specified weight percentages of some or all of the additives carbon, manganese, nickel, nitrogen, copper, chromium, molybdenum, silicon, niobium, vanadium, titanium, aluminum, and boron; reducing the slab to form plate in one or more passes in a temperature range in which austenite recrystallizes; finish rolling the plate in one or more passes in a temperature range below the austenite recrystallization temperature and above the A_{r3} transformation temperature; quenching the finish rolled plate to a suitable Quench Stop Temperature (QST); stopping the quenching; and either, for a period of time, holding the plate substantially isothermally at the QST or slow-cooling the plate before air cooling, or simply air cooling the plate to ambient temperature.