



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : C21D 8/00, 8/02, C22C 38/08, 38/12, 38/14	A1	(11) International Publication Number: WO 00/37689 (43) International Publication Date: 29 June 2000 (29.06.00)
(21) International Application Number: PCT/US99/29804 (22) International Filing Date: 16 December 1999 (16.12.99) (30) Priority Data: 09/215,772 19 December 1998 (19.12.98) US (71) Applicant: EXXONMOBIL UPSTREAM RESEARCH COMPANY [US/US]; P.O. Box 2189, Houston, TX 77252-2189 (US). (72) Inventors: KOO, Jayoung; 828 Star View Way, Bridgewater, NJ 08807 (US). BANGARU, Narasimha-Rao, V.; 5 Revere Court, Annandale, NJ 08801 (US). AYER, Raghavan; 3 North Slope, Clinton, NJ 08809 (US). VAUGHN, Glen, A.; 4211 Rice Boulevard, Houston, TX 77005 (US). (74) Agents: CASAMASSIMA, Salvatore, J. et al.; ExxonMobil Upstream Research Company, P.O. Box 2189, Houston, TX 77252-2189 (US).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: ULTRA-HIGH STRENGTH TRIPLE PHASE STEELS WITH EXCELLENT CRYOGENIC TEMPERATURE TOUGHNESS (57) Abstract An ultra-high strength, weldable, low alloy, triple phase 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 a ferrite phase, a second phase of predominantly lath martensite and lower bainite, and a retained austenite phase, 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 baron; reducing the slab to form plate in one or more passes in a temperature range in which austenite recrystallizes; further reducing the plate in one or more passes in a temperature range below the austenite recrystallization temperature and above the Ar₃ transformation temperature; finish rolling the plate between the Ar₃ transformation temperature and the Ar₁ transformation temperature; quenching the finish rolled plate to a suitable Quench Stop Temperature (QST); and stopping the quenching.		