Tungsten-Arc Welds", Metallurgical and Materials Transactions, Volume 36A, July 2005, pp.1881 – 1890.

[0004] Modification of Inconel 625 with boron reduced melting temperature and liquation cracking in the HAZ of welds produced by laser clad on GTD111 and Inconel 738 and GTD 111 nickel based superalloys as per A. Gontcharov, J. Liburdi, P. Lowden et al. "Self Healing Fusion Welding Technology", GT2014-26412, Proceedings of ASME Turbo Expo 2014: Turbine Technical Conference and Exposition, June 16 – 20, 2014, Düsseldorf, Germany. These welds had elongation of 19.7% only at a temperature of 1800° F that practically restricted use of drawing process for manufacturing of welding wire.

[0005] Therefore, additional improvement of boron modified Inconel 625 welding material was required to allow manufacturing of welding wire using standard drawing process without significant deviations from the standard chemical composition of Inconel 625. It is also an object of the concept that the welding wire should produce crack free welds on precipitation hardening superalloys, brazed and welded joints with yield strength and stress rupture properties exceeding relevant properties of standard Inconel 625 alloy.

BRIEF DESCRIPTION OF THE INVENTION

[0005a] According to an aspect of the present invention, there is provided a ductile boron bearing nickel based welding material inclusive of the following elements in weight percentages:

a) Boron: from about 0.4 to 0.6 wt. %
b) Carbon: from a trace amount to about 0.04 wt. %
c) Chromium: from about 20 to 23 wt. %
d) Molybdenum from about 8 to 10 wt. %
e) Niobium: from about 3.15 to 4.14 wt. %
f) Nickel with impurities: to balance.

[0006] We have found that to achieve the required ductility for manufacturing of welding wire using standard drawing and extrusion processes, the content of carbon in nickel based alloy comprising of 0.4 – 0.6 wt. % of boron (B), 17 – 23 wt. % of chromium (Cr), 8 – 10 wt. % of molybdenum (Mo), 0.1 – 4.15 wt. % of niobium (Nb) should not exceed about 0.04 wt. % to avoid or minimize formation of carbides.