Balochistan Journal of Engineering & Applied Sciences (BJEAS) – (p-ISSN: 2518-2706)
Volume 3, No. 2

Effect of Triple, and Quadral Phase System on Mechanical Properties in AISI-4340 Steel

Ashique Ali Lakhair, Muhammad Ishaque Abro, Umair Aftab,
Department of Metallurgy and Materials Engineering, Mehran UET, Jamshoro, Pakistan
Corresponding Email: ashique.lakhair@admin.muet.edu.pk

Abstract—The ferrite-bainite-martensite (FBM) triple, and ferrite-pearlite-bainite-martensite (FPBM) qudral phase systems are produced in the AISI4340 steel through isothermal heat treatment cycles. The effect of triple and quadral phases on strength, hardness, toughness and Percent Elongation (PE) is determined. 1. In FBM triple phase system the highest UTS 1090MPa, hardness 311 VHN, toughness 49 J and PE 16% was obtained with 10% ferrite, 60% bainite and 30% martensite. It is noted that with 10% increase in the volume fraction of bainite, 37% and 44% increase in toughness and PE at the cost of marginal decrease in hardness, hardly 6%, is resulted. 2. In FPBM qudral phase system the highest UTS 1090MPa, hardness 372 VHN, toughness 44 J, and PE 15% was obtained with 10% ferrite, 43% peralite, 30% bainite and 17% martensite. Appreciable decrease in the UTS, PE, toughness and hardness in FPBM phase system is observed with 22% decrease and increase in pearlite and martensite respectively. The Bainite-Martensite Ratio (BMR) is evaluated as one of the critical structural features and showed linear relation with strength, hardness, toughness and PE.

Keywords—AISI 4340 Steel, FBM Triple System, FPBM Qudral Phase System, Strength, Hardness, Toughness, Percent Elongation (PE), Isothermal Heat Treatment, Banite to Martensite Ratio (BMR)