Laksamee Angkurarach 2011: Effects of Direct Current on Kinetics of Boriding Process on Martensitic Stainless Steel AISI 420. Master of Engineering (Materials Engineering), Major Field: Materials Engineering, Department of Materials Engineering. Thesis Advisor: Mr. Patipan Juijerm, Dr.Ing. 100 pages.

The effects of direct current field pack boriding process on martensitic stainless steel AISI 420 have been investigated at temperatures 850, 900 and 950^{0}C for about 2, 4 and 6 h by using Ekabor I powders with direct current field of 170 mA/cm^2 The microstructure and the presence of boride layers were chaeacterized using optical microscope and X-ray Diffraction (XRD). The hardness values of the boride layer were measured by Vicker microhardness tester. Experimental results show that the direct current field can enhance the decomposition and chemical reaction in the boriding agents and also drive active force free boron ions as well as atoms to diffuse toward the cathode. Therefore, a boron concentration around the specimen at the cathode is higher than that at the anode and the reference. As a consequence, higher boride layer thickness of direct current field boriding process was detected. The double-phase boride layer (FeB and Fe_2B) was found both conventional boriding process and boriding process with direct current field. The hardness of the boride layer of about 1800-2000 HV can be observed. The kinetics of the boriding process was analyzed by diffusion and Arrhenius equations. An activation energy of conventional boriding process and boriding process with direct current field on martensitic stainless steel AISI 420 is of about 186.04 and 111.50 kJ/mol. Finally, a general equation using empirical parameters from experiment to predict the thickness of the boride layer was established for industries.

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