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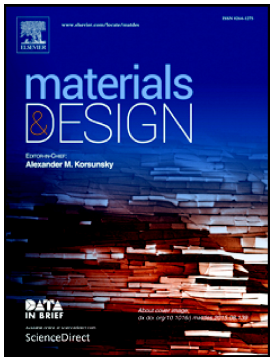

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Modeling of bake–hardening effect for fine grain bainite–aided dual phase steel

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Abstract

Bake hardening (BH) effects of dual phase (DP) steels with consideration of grain size and bainitic phase were investigated. Basically, after BH process, DP steels exhibited complex microstructure characteristic including Cottrell atmosphere, precipitation in ferrite and tempered martensite. Firstly, severe plastic deformation, namely, constrained groove pressing (CGP) was applied to a ferrite−pearlite low carbon steel for producing fine grain microstructure with submicron size. Subsequently, DP steel and DP steel with bainite were generated by intercritical annealing following by water and oil quenching, respectively. The BH at the temperature of 160ºC for 20 min was performed for steel samples with different microstructures after pre–straining to 2, 6 and 10%. Obviously, fine grain structure and bainite could effectively increase the bake hardenability of the examined steels. Additionally, micromechanics based modeling for describing flow stress behavior of the DP steels after BH was done. Hereby, influences of carbon accumulation, occurred carbides and