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Influence of the Alusi® coating on corrosion resistance of press hardened steel

Bolsanello, M.F.(1); Araujo, J.V.S.(1); Costa, I.(1); Rossi, J.L.(1);

Instituto de Pesquisas Energéticas e Nucleares(1); Instituto de Pesquisas Energéticas e Nucleares(2); Instituto de Pesquisas Energéticas e Nucleares(3); Instituto de Pesquisas Energéticas e Nucleares(4);

Press hardened steels (PHS) have been used in the last decades by automotive industries to aggregate the improvement of vehicle safety with the reduction of its heavy, also reducing CO₂ emissions. This material category, also called ultrahigh strength boron manganese steels, is capable to succeed hot stamping process, a development of the cold stamping process, that avoids spring back and allows the attainment of complex geometries. Hot stamping process consists basically on heating a steel blank until its austenitization, transferring it to press tooling, forming and quenching it to fully martensitic transformation. Besides all the advantages in the final product, the step consisted in the transference from the furnace to the press is critical for the steel, once the absence of a protective atmosphere might promote deleterious steel oxidation. To solve this problem, ArcelorMittal developed a precoated boron steel, with aluminum-silicon metallic coating, named Alusi®. The addition of this metallic layer prevents steel oxidation and peeling, however laboratorial tests indicated that the coating addition affects mechanical properties of the steel substrate, requiring special cares during conformation process. When submitted to elastic deformation, extensive cracks can form in the coating, and affect the corrosion resistance of the steel. To investigate the influence of the Alusi® coating on ultrahigh strength boron manganese steel corrosion resistance, samples of this material were analyzed with and without the coating, and results obtained were compared to evaluate the interference of the coating on the corrosion process. The tests include open circuit potential measurement, to compare the stabilization of the steel with and without the coating; electrochemical impedance spectroscopy, to compare the effectiveness of the corrosion resistance; and immersion trials, interrupted every two hours in order to monitor the formation of corrosion products. The results obtained for the two groups of samples were compared, to weigh the advantages and disadvantages of using the Alusi® on hot stamping process.