



Investigation of electrochemical behaviour of 22MnB5 steel coated with hot-dip Al-Si before and after hot stamping process by means of SKPFM measurements

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The demand for hot stamped components has been growing in structural vehicle applications, due to the advantages of combining lightweight design and safety improvement. Boron-manganese 22MnB5 steel is the most common grade for hot stamping applications. After the thermo-mechanical process, the steel exhibits up to 1,500 MPa of tensile strength with the absence of the springback effect. The hot stamping process involves heating the steel blank to the austenitization temperature and then transferring it from the furnace to the press tool, where the material is formed and quenched simultaneously. Due to high temperatures during the process, the steel blank is protected with a metallic coating to avoid the steel decarburization and oxidation. Hot-dip Al-Si is the most applied coating system on boron-manganese steel for hot stamping applications. It is known that, during hot stamping, diffusion takes place changing the coating layer morphology. The objective of this study is to investigate the effect of the hot stamping process on the electrochemical behaviour of 22MnB5 steel coated with hot-dip Al-Si by means of the SKPFM technique. Moreover, the samples were characterized by means of FE-SEM/EDS. The SKPFM results showed that, before the hot stamping process, there is a high difference of potential between the coating layer and the steel substrate. After hot stamping, this difference decreases. In both conditions (before and after hot stamping), the coating layer is less noble than the steel substrate. It was also observed that the steel substrate potential also decreased after the hot stamping process. This could be a consequence of iron diffusion towards the coating layer and the recrystallization of the substrate after the thermo-mechanical process.

Key-words: hot stamping; hot-dip Al-Si; electrochemical behaviour; SKPFM