

On the use of deuterium to characterize hydrogen uptake mechanisms in 22MnB5 bare steel

M. Mandy¹, C. Georges², T. Sturel³, P. Drillet³, P.J. Jacques¹

¹ *Université catholique de Louvain, Institute of Mechanics, Materials and Civil Engineering, IMAP, 1348 Louvain-la-Neuve, Belgium*

² *CRM group, 4000 Liège, Belgium*

³ *ArcelorMittal R&D, 57283 Maizières-lès-Metz, France*

The hot stamping process of coated boron steels is an interesting shaping solution to provide simultaneously high strength and ductility, which is compulsory for the current challenges of the automotive industry. Exposed to various atmospheres during high temperature operations, steels absorb small amounts of hydrogen, which can potentially lead to hydrogen embrittlement (HE). In this context, the general aim of this work is to understand how atmospheric sources of hydrogen lead to hydrogen uptake in Al-Si coated 22MnB5 steel during the austenitization treatment. As a reference, bare 22MnB5 steel is firstly studied and deuterium is used to distinguish the different hydrogen sources in the atmosphere. Working simultaneously with deuterium and hydrogen gives rise to isotopic exchanges and thus to the potential existence of the HD molecule. As it cannot be measured by thermal desorption analysis (TDA), this contribution is computed owing to two methods based either on probability or on equilibrium constants. Those two methods are found to be in good agreement and the influence of the HD contribution on the results is assessed.

Keywords: Hot stamping – bare 22MnB5 steel - hydrogen and deuterium uptake – isotopic exchange – thermal desorption analysis