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DAMAGE ANALYSIS OF DP600 AND DP800 STEELS UNDER TENSILE LOADING CONDITIONS

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The damage evolution in ductile metals arises from growth of existing voids and nucleation of new voids by means of mechanisms of cracking or interface decohesion of inclusions and or precipitate particles. In this work, the damage behavior of cold-rolled zinc coated dual-phase steel sheets DP600 and DP800 grades is evaluated by means of uniaxial tensile tests performed along the rolling direction. Firstly, the ferrite and martensite phases of DP600 and DP800 steels as well as the average grain sizes were determined by means of optical microscopy technique and image analysis. Secondly, the nucleation and growth of voids in these steels were evaluated as a function of the plastic strain level imposed in uniaxial strain deformation mode. Light optical microscopy technique was used to analyze the voids and determine the void density, void area fraction, void aspect ratio and average void size from the microstructures of deformed uniaxial tensile specimens. The proposed procedure allowed identifying both dual-phase steels parameters of the Gurson-Tvergaard-Needleman damage model by means of finite element simulations of the uniaxial tensile tests. DP800 steel displayed improved strain-hardening and increased yield strength along with a lower critical strain to failure owing to the higher martensite volume fraction. The resulting ductility effect can be attributed to the void nucleation sites which increase with the amount of martensitic islands and ferrite-martensite interfaces.