Fatigue resistance evaluation of high-strength steels through a new method based on stiffness evolution

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ABSTRACT

In the last decade, the use of high-strength steels has helped the automotive industry to reduce the weight of vehicles and achieve environmental goals. However, there is still room for optimization, especially on the new electric platforms or larger structures such as heavy-duty vehicles. These components, like many in the industry, are fatigue dimensioned and require extensive knowledge of this key design parameter that is time-consuming and expensive to obtain. To overcome this limitation, a new testing method based on damage mechanics has been developed. The method allows determining fatigue endurance rapidly and easily. In this way, it is possible to test many different materials in a short time and consider different aspects that could influence fatigue behaviour, such as forming operations. This work addresses the knowledge behind the method by testing a high Mn-TWIP steel and relating it to continuum damage and fracture mechanics. The method is also applied to a press-hardened 22MnB5 steel with different heat-treatment conditions to evaluate its effect on fatigue strength. Highlighting in this way the main application of the method for material screening and parameters optimization for a superior fatigue performance.