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JFE Steel has newly developed two kinds of steel tubes having excellent fatigue endurance for automotive suspension parts. The tube employed to torsion beam has an excellent combination of fatigue endurance, hydro-formability and delayed fracture resistance. These properties can be obtained by the low C (less than 0.3%) based chemistry and the high precision controlled rolling and cooling technique in hot rolling. Further developed steel tube for stabilizer exhibits also excellent fatigue endurance induced from its high r-value (more than 1.5) property. This excellent crystallographic characteristics can be obtained by the warm reducing in the "HISTORY" process and contribute to improve the fatigue life by suppressing the wall thickness reduction during bending applications. Moreover, JFE Steel has been promoting the application of steel tube to automotive suspension parts, with not only newly developed steel tubes mentioned above, but also with the analysis of the formability of high strength tube in rotary draw bending process and the development of the related new rotary bending method without both mandrel and wiper.

1. Introduction

Automotive parts made of steel sheet, steel bar, or forged steel have often been substituted with hollow parts made of steel tube in recent years, as an effective way of simultaneously reducing the car body weight to improve fuel consumption and of strengthening the car body for occupant protection.

The steel tubes for these parts are requested to have higher performance than ever, including the ability to withstand extremely severe plastic working, even though they are high strength steel tubes and high carbon steel tubes.

With this background, JFE Steel has developed suitable steel sheet base materials and processes for manufacturing steel tubes, and has developed high performance steel tubes including 780 MPa class excellent formability electric resistance welded (ERW) steel tubes[1], and excellent formability and high dimensional accuracy HISTORY steel tubes[2]. In addition to these high performance steel tubes, JFE Steel has f exibly combined secondary tube-forming technologies such as bending of high strength steel tubes and techniques for evaluating the performance of steel tubes, shown in **Fig. 1**, thereby developing steel tube products for automotive torsion beams, stabilizers, and lower arms.

This paper describes the recent development of these products.

cross section to the torsion beam suspension[3–5]. When particularly high static strength and fatigue enclurance are required, strengthening by quenching is effective. However, the forming of unequal section in torsion beam requires hydro-formability and press-formability, both of which counteract the strength increase. Furthermore, weldability, phosphatability, low temperature toughness, hydrogen embrittlement resistance, are also important characteristics for practical applications. This section describes the material characteristics of steel tubes for quench type torsion beams, developed to provide the above necessary characteristics.

2.1 Effect of Strength and Microstructure on the Torsional Fatigue Endurance

The effect of strength and microstructure on the fatigue endurance was evaluated using a laboratory vacuum-fused material having a composition of 0.1–0.2%C-0.4%Si-1.9%Mn-0.2%Cr-0.2%Mo-0.01%P-0.001%S. The prepared ingot was hot-rolled, and one hot-rolled sheet was then heated to an austenite-ferrite two-phase region, while another one was heated to an austenite single-phase region in a salt bath, each of which was immediately quenched by water, and then was tempered. Using their round bar specimens of 6 mm in diameter at parallel portions, torsion fatigue characteristics were evaluated under a stress ratio of −1 and repetition rate of 33 Hz.

Photo 1 shows microscopic structures after heat

3. HISTORY Steel Tube for Stabilizer

For automobile chassis parts such as stabilizers,

ERW steel tube (B) and the HISTORY steel tube (D). In further high strength regions, signi f cant local necking occurred in the heat-treated ERW steel tube (C), though very little local necking occurred in the 780 MPa class HISTORY steel tube (E).

There are a few reports[22] on the in f uence of mechanical properties of mother tube on the wall-thickness reduction, and no reports on the matter relating to high strength steel tubes. To investigate the in f u-ence of mechanical properties and working conditions on the maximum wall-thickness reduction rate during rotary draw bending, the experimental results of the rotary draw bending for 370–780 MPa class steel tubes were applied to the statistical analysis. The applied mechanical properties were uniform elongation (uEl) and the r-value in the longitudinal direction of the tube (r_{ϕ}). The applied bending condition was the back boost pressure ratio induced by the tube booster (z = P0 0 os