경량차체 설계를 위한 고장력강의 동적물성치 연구

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A Study on Dynamic Material Properties of High Strength steels for the Design of the Light-weight Auto-body

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Abstract

The light-weight and safe design of an auto-body structure becomes an important challenging issue in the automotive industry in order to increase the fuel efficiency satisfying the emission-gas regulation of vehicles and to ensure the safety of passengers against the car crash. In order to achieve the two contradictory purposes, the crash analysis of the high speed deformation has to be accurately carried out with the accurate stress-strain curves at the high strain rate. The flow stress of a material generally increases as the strain rate increases, and that is regarded as the inherent characteristics of a material. An accurate car crash simulation needs accurate information of material data at the strain rate up to several hundred per second since the strain rate of the local deformation in the car crash reaches up to the range of 300 /sec ~ 500 /sec.

In this paper, the tensile testing method with variation of the strain rate at the intermediate strain rate is established and tensile tests of high strength steel sheets for an auto-body have been performed to obtain dynamic material properties. A high speed tensile testing machine used in tensile tests was able to obtain the tensile material properties at the strain rate up to 500/sec. A simple jig fixing a specimen was designed to diminish the load ringing phenomenon induced by unstable stress propagation at the high strain rate and to enhance the accuracy to acquire the stress. The tensile testing of high strength steel sheets have been carried out to obtain stress-strain curves at the strain rate up to 200 /sec. The test results provide new tendency of stress-strain curves at the intermediate strain rates and demonstrate that the strain hardening and the strain rate hardening are strongly coupled together. The low strength steel is more sensitive to the strain rate than the high strength steel and the strain rate sensitivity generally decreases as the strain increases and the strength of a steel sheet increases.

Key Words : Dynamic Material Properties (동적물성치), High Strength Steel (고장력강), Intermediate Strain Rate (중변형률 속도), High Speed Tensile Testing Machine (고속인장시험기)

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