

# Influence of Nb and Mn Content on Resistance to Delayed Fracture of Ultrahigh Strength Hot Stamped Steel Sheets

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## Abstract

One of the important objectives of hot stamping technology is an increase in tensile strength up to 2000 MPa. The largest obstacle to the realization of the strength increase to this height is a concern over the occurrence of delayed fracture. However, the principle idea for designing chemical compositions and operational conditions for increasing the resistance to delayed fracture has not been established yet.

In this paper, the effect of Mn and Nb on the resistance to delayed fracture has been investigated to obtain the principle idea for designing chemical compositions for increasing the resistance to delayed fracture of ultrahigh strength hot stamping steel sheets. The following results were obtained.

Nb addition increased the resistance to delayed fracture. A decrease in added Mn also increases the resistance to delayed fracture. Detailed investigations on the effect of Nb and Mn on the resistance to delayed fracture indicated that these alloys in solution, especially segregated in the grain boundary, affected the resistance to delayed fracture. A key requirement to improve the delayed fracture property is to control the segregation behavior of Nb and Mn.

## 1 Introduction

For automotive steel components, weight reduction and the improvement of crashworthiness have been carried out by increasing their strength. Hot stamping technology is now the most attractive manufacturing method to produce ultrahigh strength automotive steel components.

Current important issues of the hot stamping technology are the improvement of its productivity and the development of hot stamping steel sheets with higher strength. The strength grade of conventional hot stamped steel sheets is 1500 MPa. Exceptionally, 1800 MPa grade was commercialized to produce bumpers by a Japanese automotive company about a decade ago [1]. Subsequent application of this grade to other automotive components is, however, limited because of concerns over the occurrence of delayed fracture. Recently, a technical paper was published concerning the development of 1900 MPa grade hot stamping steel sheets [2]. However, the delayed fracture issue was not reported in detail. It is an essential issue for commercializing hot stamping steel sheets with higher strength to remove the concern over the occurrence of delayed fracture.