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## MECHANICAL PROPERTIES AND MACHINABILITY OF A HIGH STRENGTH, MEDIUM CARBON, MICROALLOYED STEEL

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### ABSTRACT

The development of a high strength (tensile strength beyond  $900 \text{ N/mm}^2$ ), medium carbon, vanadium microalloyed steel for hot forged automotive components has been reviewed in the paper.

The influence of different alloying elements was investigated. The most effective elements to increase the strength were chromium and manganese. In TEM investigation was found that in comparison with the lower strength melt chromium + manganese alloyed steel showed a high density of small V(C,N) precipitates. Mechanical properties were studied in tensile, impact, fatigue and fracture mechanics tests. Most mechanical properties of the microalloyed and Q&T steel were essentially equal. Exceptions were the lower impact strength and higher fatigue strength of the microalloyed steel. The possibilities to improve the impact strength of the microalloyed steel are being considered. Machinability was tested in different operations. Generally the machinability of the high strength microalloyed steel was comparable with Q&T steels. However, a different behaviour was found in deep hole drilling. The use of calcium treatment to improve the machinability is discussed.

The high strength microalloyed grade developed is able to substitute for alloyed Q&T steels in most components. When weight saving is desired, the possibility of substituting for lower strength microalloyed steels by the high strength grade is considered.

### INTRODUCTION

Ferritic-pearlitic microalloyed steels have substituted for Q&T steels in hot forgings due to the reduction in production costs. The principal saving is achieved by the elimination of the separate Q&T treatment after hot forging. There is also a decreased need for cold straightening and stress relieving annealing.

Untill now, microalloyed steel have substituted mainly for the low strength, i.e. unalloyed

Q&T steels. However, great potential cost reductions lie in the substitution of the higher strength, alloyed Q&T steels with the tensile strength beyond  $900 \text{ N/mm}^2$ .

The purpose of this paper is to describe the development, properties, and uses of a new, high strength, microalloyed steel with a minimum tensile strength of  $900 \text{ N/mm}^2$ .