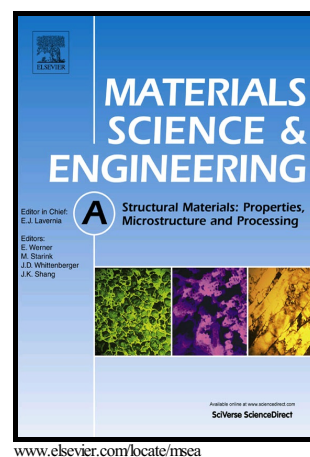


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Md. Basiruddin Sk, Irshad Alam, Debalay Chakrabarti



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# The role of fibrous morphology on the Charpy impact properties of low carbon ferrite-bainite dual phase steel

Md. Basiruddin Sk<sup>1\*</sup>, Irshad Alam<sup>1</sup>, Debalay Chakrabarti<sup>1</sup>

\*Corresponding author, email address: basiruddin.sk@gmail.com

1. Department of Metallurgical and Materials Engineering, Indian institute of Technology  
Kharagpur, 721302, India.

## Abstract:

Primarily ferrite-pearlite microstructure having coarse ferrite grain size (24  $\mu\text{m}$ ) and high pearlite fraction (42%) offered YS  $\sim$  575 MPa with poor impact properties such as, upper shelf energy (USE) of only 30 J and ductile brittle transition temperature (DBTT) as high as 27°C in an industrially hot-rolled plate of 0.25 wt.% C steel. In order to improve the strength along with the impact properties by developing ferrite-bainite microstructures, two different types of heat-treatments, namely step-cooling (SC) and intermediate cooling (IC) treatments, were carried out on the as-received material. Significant improvement in strength along with the impact toughness (with YS of 740 MPa, USE of 222 J and DBTT of -57°C) has been achieved by developing fibrous microstructure, with alternate thin-films (2-4  $\mu\text{m}$  thick) of ferrite and bainite through intermediate cooling (IC) treatment. Fine film-like structure with large orientation difference across the ferrite-bainite interface boundaries not only increased the strength but also resulted in frequent deflection in cleavage crack propagation path which improved the low-temperature impact toughness and reduced the DBTT.

**Key words:** Dual phase steel; Ferrite-bainite microstructure; Strength; Impact toughness; Crystallographic orientation; Cleavage crack propagation.

## 1. Introduction

An excellent combination of strength, ductility and impact toughness is an essential requirement of the steel grades used for construction, linepipe, pressure vessel, automotive, naval and defense applications [1–12]. Ferrite-martensite or ferrite-bainite dual phase steels can be

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