

METHOD FOR PRODUCING QUENCH AND PARTITIONED STEEL WITH DUAL PHASE MICROSTRUCTURE AND IMPROVED MECHANICAL PROPERTIES

IITM Technology Available for Licensing

Problem Statement

- The automotive industry requires steels that are both lightweight and possess high strength and ductility.
- There is a challenge in optimizing the microstructure of low-carbon steels to increase the amount and stability of retained austenite, which enhances strength and formability.
- The impact of different alloying elements on the microstructure and mechanical properties of Quench and Partitioned (Q&P) steels remains insufficiently understood.

Intellectual Property

- IITM IDF Ref. 1431
- IN 349064 - Patent Granted

Technology

The invention focuses on developing lightweight, high-strength, and high-ductility steels, specifically for automotive applications, using a quench and partitioning (Q&P) process that results in a dual-phase microstructure.

The Q&P process, involving precise temperature control during quenching and partitioning, enhances the stability and amount of retained austenite in the steel, leading to improved mechanical properties such as tensile strength (1150-1300 MPa) and elongation (~18%).

Two new steel compositions (Steel B and C) were designed, showing a significant improvement in strength and ductility compared to other commercial high-strength steels, making them promising for automotive use with optimized alloying elements and heat treatment parameters.

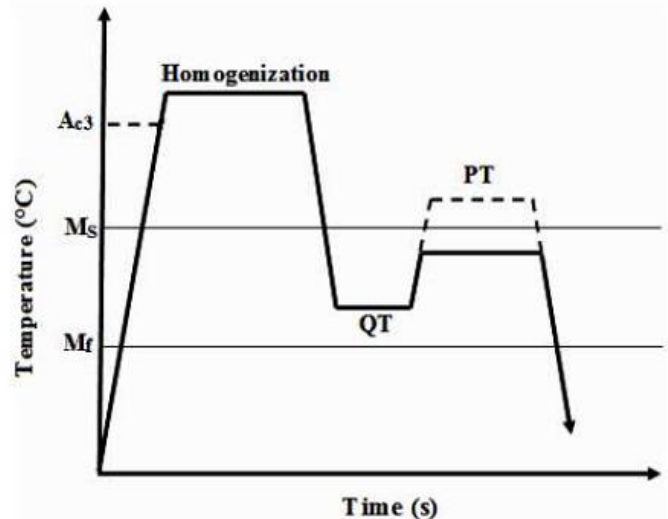


FIG. 1. Schematic heat treatment cycle of quench and partitioning process.

Technology Category/ Market

Category - Advanced High Strength Steels, Advance Material & Manufacturing Applications - Automotive Body Panels, Suspension Systems, Agricultural Machinery
Industry - Automotive, Aerospace

Market - Advanced high strength steel (AHSS) market size is projected to be worth US\$ 49.6 Bn by 2034, growing at a **CAGR of 7.9%** by 2034.

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Research Lab

Prof. Hari Kumar K.C,
Prof. Sankaran S,
Dept. of Metallurgical and Materials Engineering, IITM

CONTACT US

Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

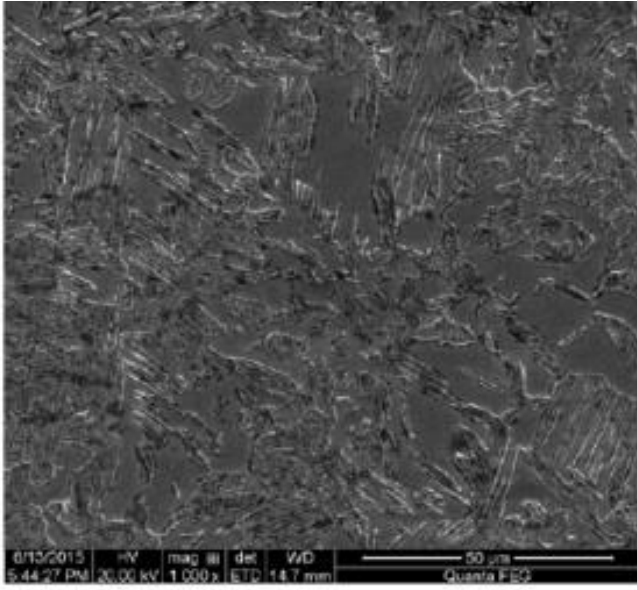
IITM TTO Website:
<https://ipm.icsr.in/ipm/>

Email: headtto-icsr@icsrpis.iitm.ac.in

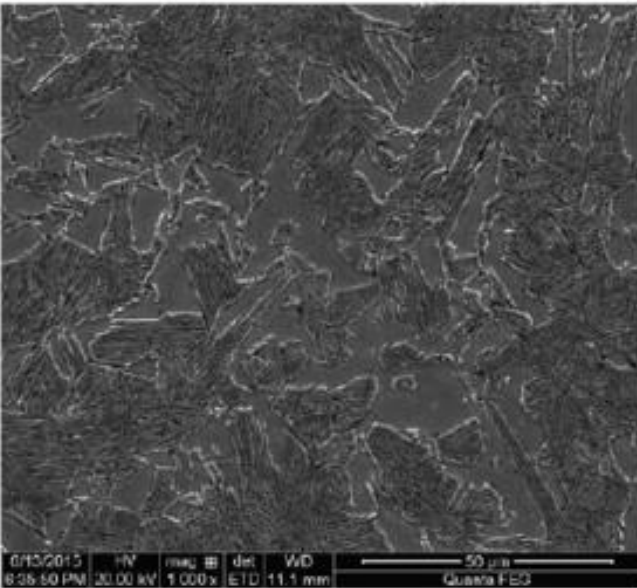
tto-mktg@icsrpis.iitm.ac.in

Phone: +91-44-2257 9756/ 9719

FIG. 2. Shows FESEM micrograph of quench and partitioned steel B and C (2a & 2b) respectively.



a



b

Key Features / Value Proposition

- Achieves impressive tensile strength (1150-1300 MPa) with 18% elongation, ideal for demanding automotive applications.

1. High Strength and Ductility



- Tailored microstructure with 22% retained austenite and martensite enhances mechanical properties and performance.

2. Optimized Dual-Phase Microstructure



- Offers a superior strength-to-weight ratio, making it a cost-effective solution for lightweight automotive designs.

3. Lightweight and Efficient



- Flexible quench and partitioning parameters allow precise control over mechanical properties, ensuring consistent quality.

4. Customizable Processing

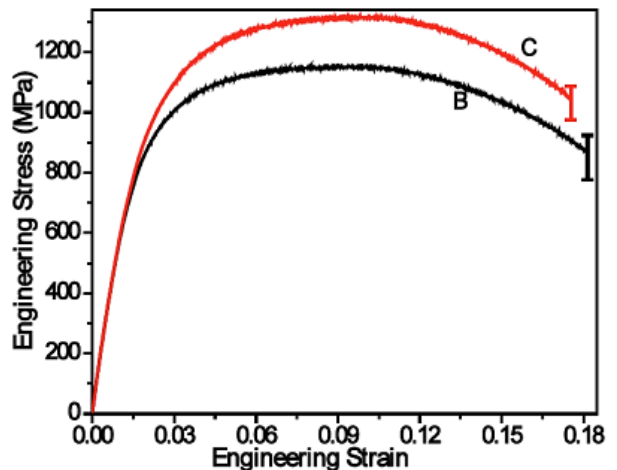


FIG. 3. Shows engineering stress Vs engineering strain plot.

CONTACT US

Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:

<https://ipm.icsr.in/ipm/>

Email: headtto-icsr@icsrpis.iitm.ac.in

tto-mktg@icsrpis.iitm.ac.in

Phone: +91-44-2257 9756/ 9719