AR MDN 250 steel

Planar slip deformation behaviour

AR

HPT

Crack branching phenomenon

AR

HPT

Transformation Induced Plasticity (TRIP) in overaged condition

AR

HPT

Failure behavior of nano structured Maraging steels

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AR MDN 250 steel

HPT processed MDN steel

Planar slip in AR was detrimental for tensile stress at the cost of strength

AR

HPT

Increased ductility at the cost of strength

AR

HPT

Increased strength at the cost of ductility

AR

HPT

Fracture tests were carried out in a Jinan ™ UTM coupled with an in-situ optical DIC strain measurement (Sobriety™ Mercury DIC software)

AR conditions

HPT conditions

HPT+C

HPT+OA

Fracture toughness values for different processing conditions

Planar slip deformation behaviour

AR

HPT

Crack branching phenomenon

AR

HPT

Transformation Induced Plasticity (TRIP) in overaged condition

AR

HPT

Conclusion

• Planar slip in AR was detrimental for tensile stress-strain behaviour and yet enhanced fracture toughness through crack branching
• Absence of planar slip and occurrence of TRIP effects due to reverted austenite enhanced the overall ductility and fracture toughness of AR+OA at the cost of strength
• Nano scaled reverted austenite formed through HPT processing showed significant TRIP effect leading to enhanced crack tip toughening and improved fracture toughness

Acknowledgements

• Max Planck Society and IRCC seed grant for funding provided to carry out this work
• Central facilities at IIT Bombay

HPT processing

Peak strength after deformation and aging = 2.9 GPa

Peak strength after deformation and aging = 1.7 GPa

Presence of ultrafine grains without texture prevented planar slip

Increased ductility at the cost of strength

Increased strength at the cost of ductility

AR+OA at the cost of strength