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Dynamic mechanical properties and fracture response of Dual Phase steels spanning a strain rate range of 10^2/s to 10^6/s. SUKANYA M SHARMA, Georgia Institute of Technology, SHRIKANT BHAT, ArcelorMittal Global RD, ARUN GOKHALE, NARESH THADHANI, Georgia Institute of Technology, HIGH STRAIN RATE AND STEREOLOGY TEAM — The dynamic mechanical properties and spall fracture response of three commercial Dual Phase (DP) steels under strain rates of 10^2/s-10^6/s are described in this work. DP steels are used in automotive industry due to their combination of high strength and moderate ductility. Formability and crash resistance expose the steel to high strain rates and are driven by microstructure. DP steels in this work contain ferrite and ˜65% of a harder phase (mixture of martensite and bainite). Two steels have protective galvannealed coating and one of the coated steels contains decarburized surface layer & gradient microstructure. Stereological techniques are used to quantify features in microstructures and reveal differences in phase distribution due to changes in processing conditions. Dynamic mechanical properties at strain rates in the range of 10^2/s-10^6/s, achieved using a hopkinson bar and plate on plate impact tests show that while the strength of these steels exhibit a positive strain rate sensitivity and increase with strain rate, the strain to fracture is more a function of the underlying microstructure. Quantitative fractography of the fracture surfaces at different strain rates reveal sensitivity of operative micromechanisms to strain rate, loading conditions and microstructure.

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