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Spall of a High Strength, High Toughness Fe-Mn-Cr-Ni-Mo-Si-0.28C Steel CHRISTOPHER NEEL, SEAN GIBBONS, RACHEL ABRAHAMS, US Air Force Research Laboratory — We investigate the spall behavior of a high strength, low-alloy Fe-Mn-Cr-Ni-Mo-Si alloy steel using gun-driven, planar-shock impact studies. The study utilized laser velocimetry to obtain the spall strength using the form of the "pullback" in the velocity profile, and also soft-recovery and post-experiment metallurgical examination using both optical and electron microscopy to investigate the underlying mechanisms of spall failure. We also report a spall failure sequence in which voids nucleate and grow beginning at the incipient spall threshold and initially become more prevalent as the impact velocity increases. Then, as the impact velocity increases further, traditional void nucleation becomes almost completely absent and is replaced by adiabatic shear bands occurring along the spall plane. Finally, as impact velocity continues to increases, voids re-form and eventually result in complete spall failure. Throughout the range of velocities between incipient and complete spall, the calculated spall strength remains approximately constant at 6.7 GPa, which compares favorably with other low alloy steels. We compare these observations with similar spall studies of other steels and speculate on the underlying cause of the unusual spall failure sequence.

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