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Processing Maraging Steel by L-DED: Repair of H13 Substrate and in-Situ Heat Treatment

Anselmo Thiesen Junior[1]; Carlos Enrique Niño Bohórquez[1]; Leandro João da Silva[2]; Henrique Santos Ferreira[3]; Jurandir Sousa[3]
1. Universidade Federal de Santa Catarina; 2. Universidade Federal do Paraná; 3. Instituto SENAI de Inovação em Laser.

Introduction

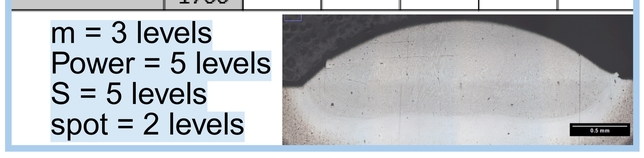
H13 tool steel is widely used in molds and dies but is susceptible to wear and thermal fatigue. L-DED enables efficient repair using 18Ni300 maraging steel, offering high strength, toughness, and weldability. However, precipitation heat treatments delay the return of repaired tools to service. That being said, the objectives are:

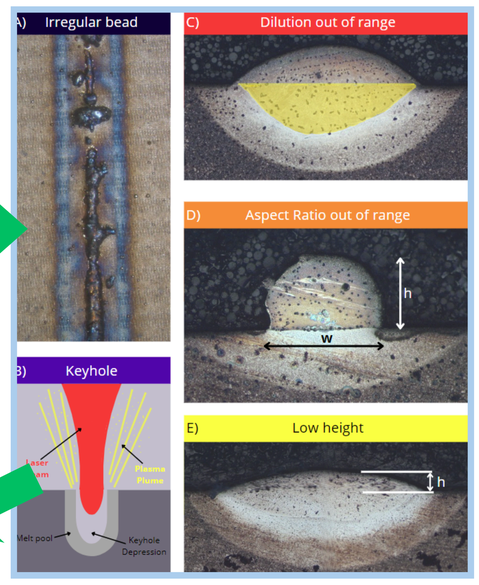
- Select the L-DED processing parameters to deposit 18Ni300 over an H13 substrate;
- Simulate thermal cycles for multilayer depositions;
- Evaluate the difference between two dwell-time conditions.

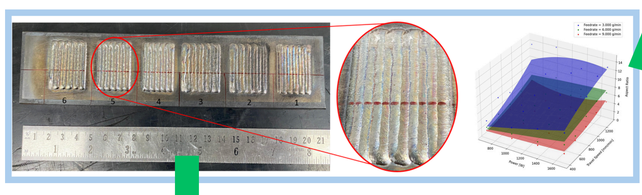
Methodology

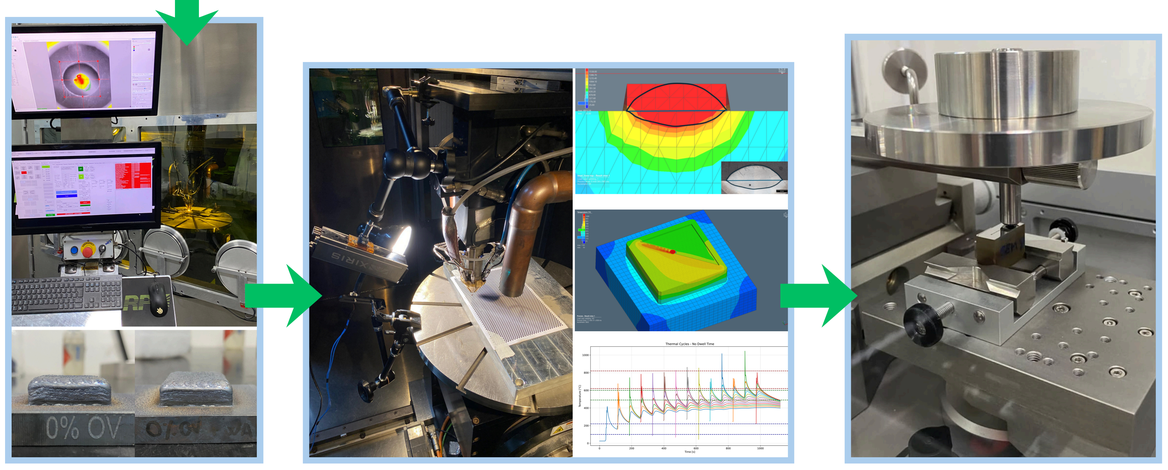
	m=6 [g/min] / spot size=1.8 [mm]				
	Travel Speed [mm/min]				
Power [W]	400	625	850	1075	1300
350					
688			29	30	...
1025		28	26	27	
1363					
1700					

m = 3 levels
Power = 5 levels
S = 5 levels
spot = 2 levels



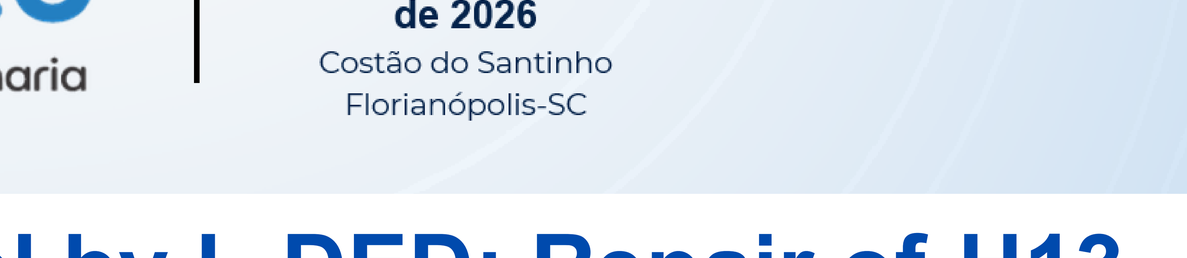




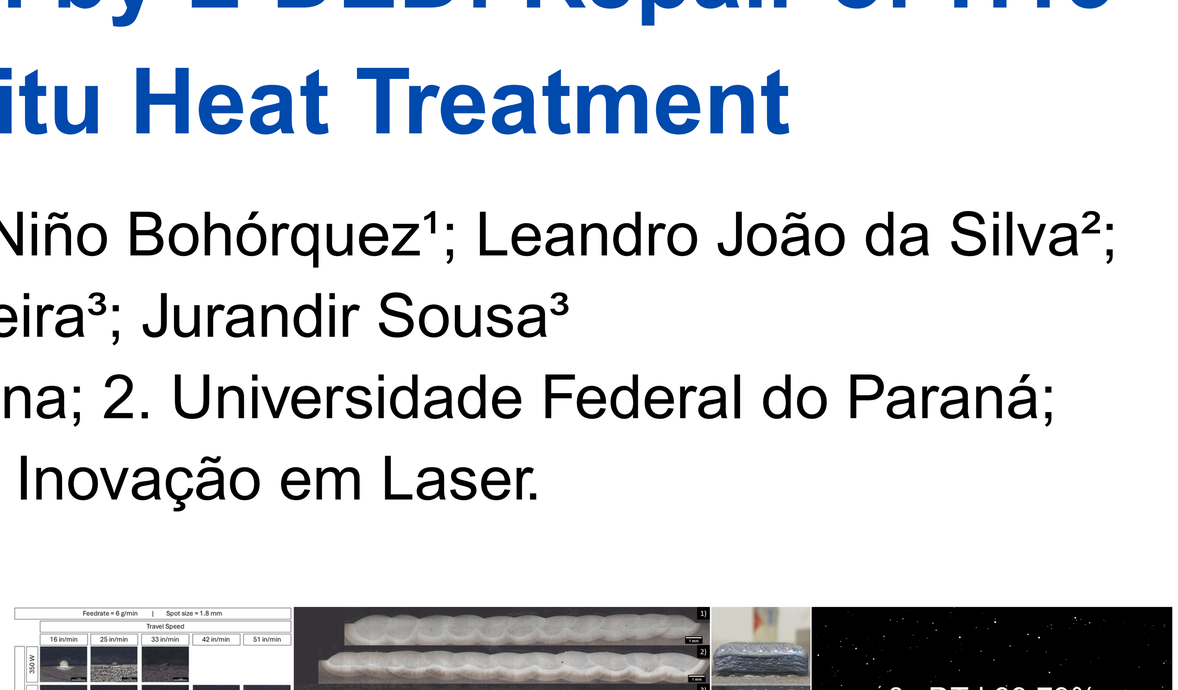


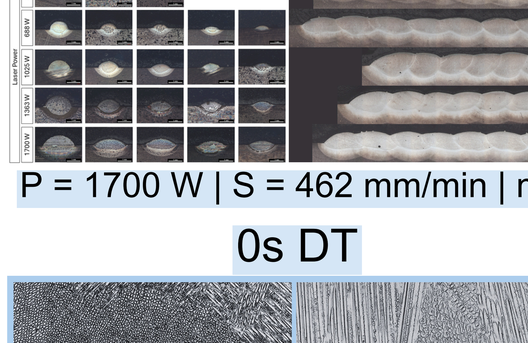
Results and Discussions

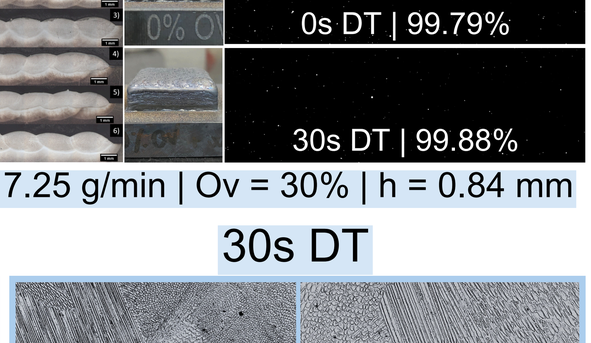
No cracks were observed at the interface between the substrate and the deposited material. The density obtained for the selected parameter was approximately 99.8%. The microstructure of the cubes are heterogeneous in both morphology and refinement.
Although the hardness was similar between the two conditions, COF obtained through the ball-on-plate test was different. 0sDT presented abrasion (scratch) while 30sDT exhibited adhesion (deformation).

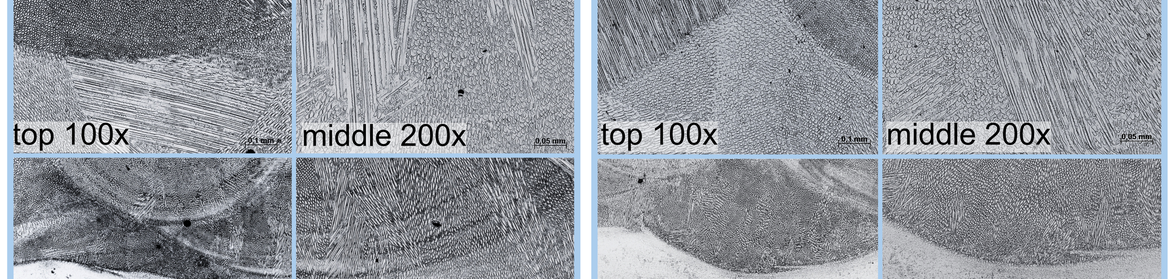


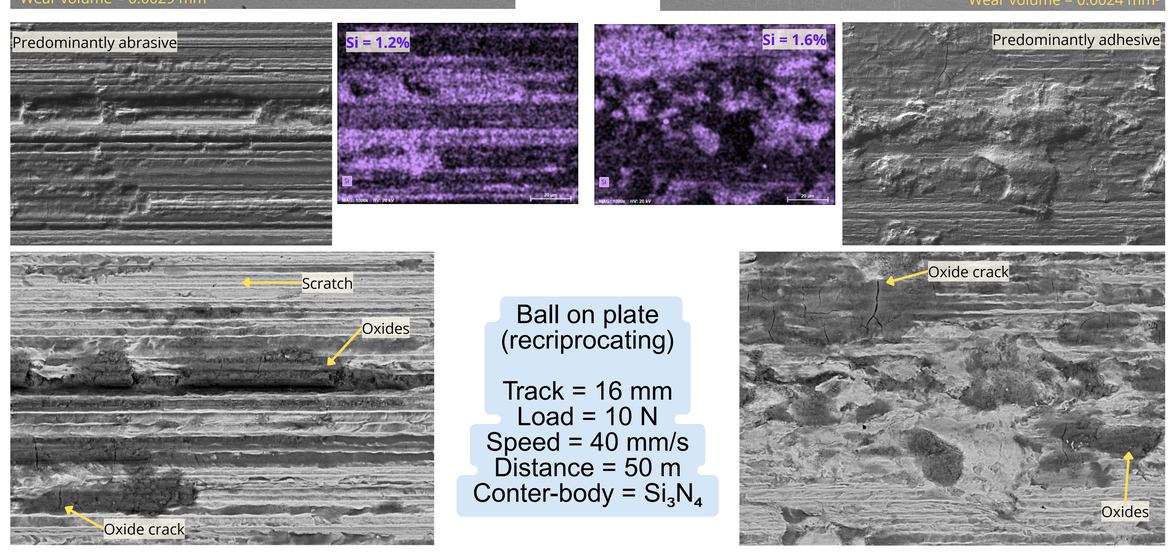
P = 1700 W | S = 462 mm/min | m = 7.25 g/min | Ov = 30% | h = 0.84 mm











Conclusions

COF and wear volume behavior were not determined by hardness but by active wear mechanisms, indicating that thermal cycles during deposition strongly influenced tribological behavior.