

Wear properties improved by laser surface melting in martensitic stainless steel

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Abstract – One of the ways to enhance the wear properties in martensitic stainless steel is through the laser surface treatment. This treatment consisting in melt the surface layer sample by laser, which consequently may improve the wear resistance. In this research, ASTM 487 CA6NM stainless steel alloy samples were subjected to laser surface melting and the microstructure obtained was characterized by optical microscopy, scanning electron microscopy, Vickers microhardness and X-Ray diffraction. The wear was analyzed by abrasive wear tests.

The ASTM 487 CA6NM martensitic stainless steel [1], whose chemical compositions are listed in Table 1 is used to manufacture many turbines parts like the rotor, the blade and the hub. These components always had wear problems and to improve the wear resistance has been used laser surface treatment [2]. The treatment was carried out by a CW 2 kW fiber laser operated at power of 400 W, a scan laser beam rate from 600 mm/min to 1200 mm/min and a defocusing beam size from 6mm to 18mm. Surface oxidation was prevented using 20 l/min argon gas.

Microstructure analysis, microhardness and pool dimensions measurement were carried out in the whole range of experimental conditions to set the optimal parameters. In order to cover the sample and to ensure a homogeneous layer was used a laser beam overlapping of 50%.

The laser treated samples present a very homogeneous melted layer. Analysis by optical microscopy (Fig. 1), scanning electron microscopy, X-Ray diffraction, Vickers Microhardness (Fig. 2) and abrasive wear test [3-4], had shown a great improvement on the hardness and wear properties after the laser treatment.

We can conclude that the laser surface melting could be used to improve the martensitic stainless steel ASTM 487 CA6NM properties.

Table 1: Chemical compositions of ASTM 487 CA6NM (wt.%).

	C	Si	Mn	P	S	Cr	Ni	Cu	Mo	V	W
Analyzes	0,03	0,40	0,74	0,03	0,003	12,75	3,78	0,21	0,4	0,037	0,02
ASTM A487	0,06	1,00	1,00	0,04	0,03	11,5 – 14,0	3,5 – 4,5	0,5	0,4 – 1,0	0,05	0,1

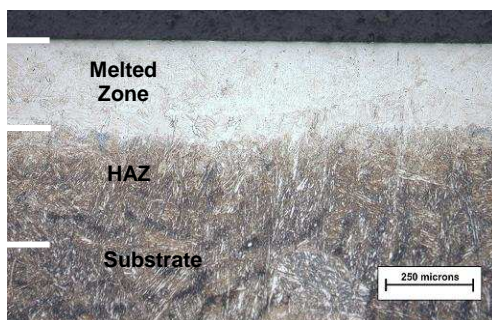


Figure 1: Structure of the melted ASTM 487 CA6NM.

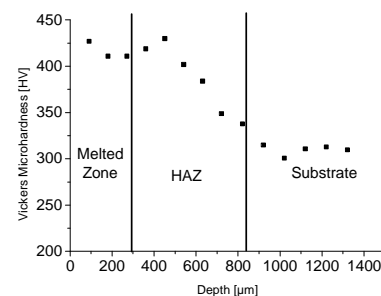


Figure 2: Vickers Microhardness profile after laser melting

References

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