

Technical Report

for Ultrasonic Impact Surface Process

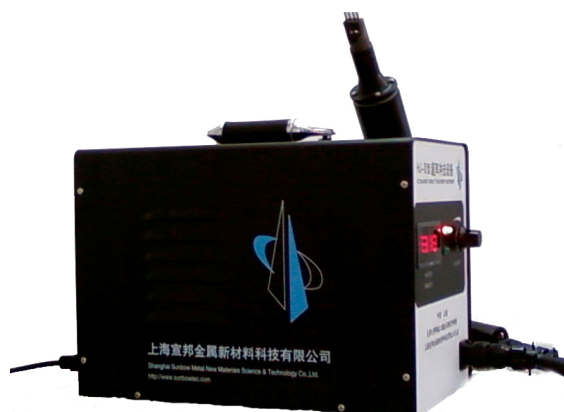
Part one: Equipment

Equipment name: BM-I Ultrasonic Impact Surface Process Equipment

1.1 Equipment Parameter

Parameter	Value	Parameter	Value
Energy converter	Piezoelectric ceramic	Cooling method	Wind Cooling
Working Voltage	220V±10%, 50Hz±5%	Output power range	50~300W
Output Power	300W	Output power step	Continuous
Drive Current	0~3A	Working Mode	Load consistence 90%
Working Frequency	20±2KHz	Size of power box	350×200×250mm
Amplitude	15~50μm	Weight of power box	7 Kg
Application of force	0~90N	Working temperature	0 ~+35 °C

1.2 Picture of Equipment



Part two: Brief Technical Introduction

Due to the characters of material, the working depth of Ultrasonic Surface Process Equipment is from 0.1um to 1mm, with a surface smoothness of 0.02um and a 100um deep nanocrystal surface.

Seen from the processed materials such as Ti alloy, 40Cr, No.45 Steel and Al alloy, the equipment show its great effort. For instance, after processing, 40Cr gets a 0.15um surface smoothness and a 60um-deep surface nanocrystal.

Part three: Effect of Roughness by using Ultrasonic Impact Surface Process

3.1 Roughness analysis of 45 steel

As it shows in the figure 1, there is a distinct difference about the surface roughness of 45 steel by using BM-I. This process makes the steel surface smooth and glistening.

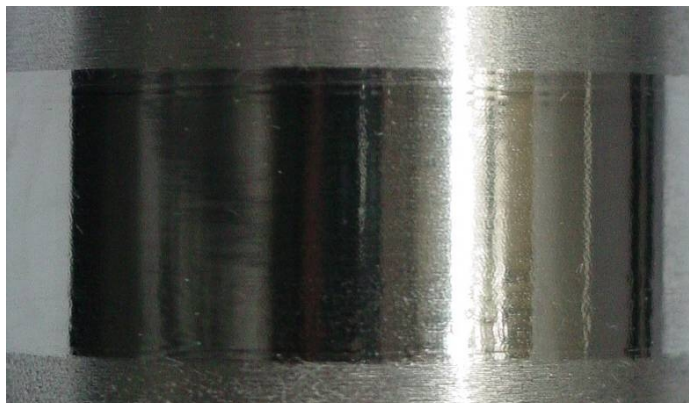


Figure 1 Comparison of 45 steel surface before and after ultrasonic impact

The chart 1 shows the result of surface roughness testing of 45 steel by using ultrasonic impact surface process. The tester is high precision inductance roughness tester which can ensure the precision and reliability of the result.

Chart 1 Roughness of 45 steel

45 steel	Roughness Ra/ μm			Average Ra/ μm
	1	2	3	
Original specimen	6.6	7.2	7.5	7.1
Impacted specimen	0.18	0.20	0.20	0.19

3.2 Roughness analysis of 40Cr steel

As it shows in the figure 1, there is a distinct difference about the surface roughness of 40Cr steel by using BM-I. The left picture is specimen impact by BM-1, and the right one is normal polished specimen.

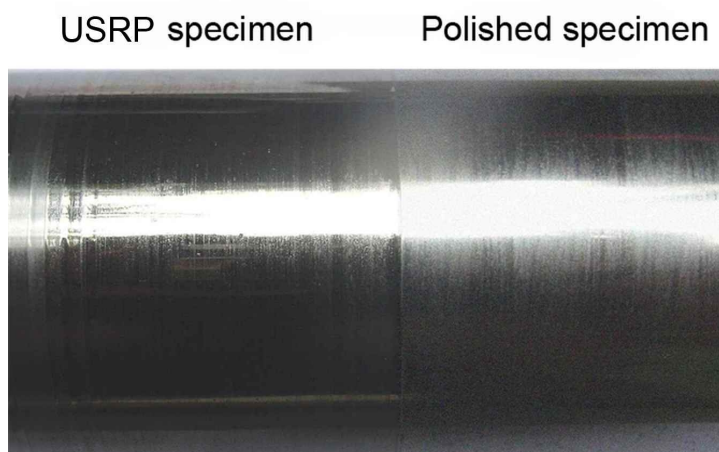


Figure 2 Comparison of 40Cr steel surface by ultrasonic impacted and polished

The chart 2 shows the result of surface roughness testing of 40Cr steel by using ultrasonic impact surface process. The tester is high precision inductance roughness tester which can ensure the precision and reliability of the result.

Chart 2 Roughness of 40Cr steel

40Cr	Roughness Ra/ μm			Average Ra/ μm
	1	2	3	
Polished specimen	0.36	0.35	0.34	0.35
Impacted specimen	0.085	0.12	0.09	0.098

Part four: Surface Hardness Analysis

4.1 Hardness analysis of 45 steel

We use MHV2000 microcosmic hardness tester to test the hardness variation of specimen in the depth dimension impacted by BM-I. The loading weight is 10g, while the impact time is 10s. The detail result after ultrasonic impact process shows in figure 3 as below.

It is apparent that the surface hardness increases significantly after impacted by BM-I, and the hardness get smaller as the testing place goes deeper. Compared with the original specimen, the hardness of the surface of impacted specimen increases to double (from HV230 to HV460). While the hardness less deep than 200 μm increases a lot.

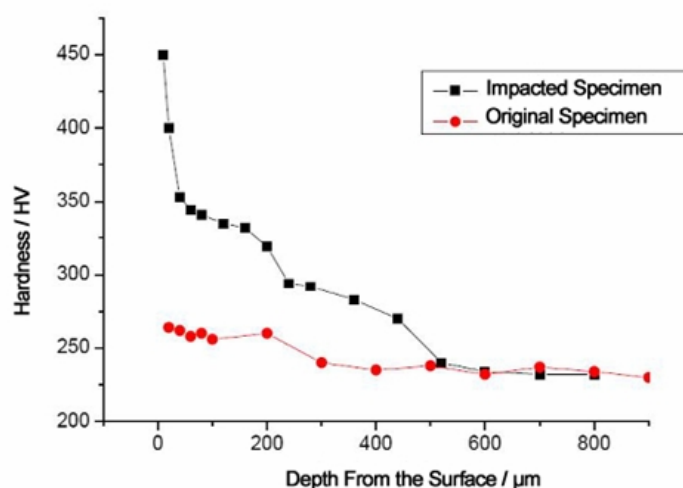


Figure 3 Hardness variation of 45 steel in the depth dimension impacted by BM-I

4.2 Hardness analysis of 40Cr steel

We use MHV2000 microcosmic hardness tester to test the hardness variation of

specimen impacted by BM-I in the depth dimension. The loading weight is 10g, while the impact time is 10s. The detail result after ultrasonic impact process shows in figure 4 as below.

It is apparent that the surface hardness increases significantly after impacted by BM-I, and the hardness get smaller as the testing place goes deeper. Compared with the original specimen, the hardness of the surface of impacted specimen increases to triple (from HV347 to HV1460). While the hardness less deep than 100 μ m increases a lot.

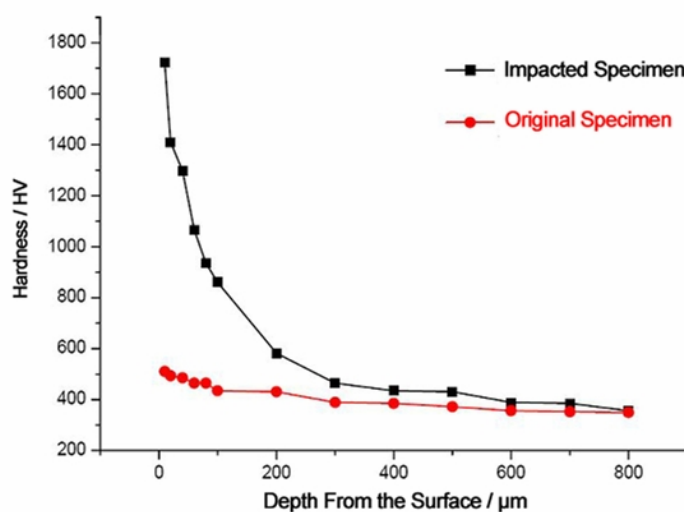


Figure 4 Hardness variation of 40Cr steel in the depth dimension impacted by BM-I

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