

# **Investigation Into Laser Shock Processing**

**Yilbas, BS; Arif, AFM; Shuja, SZ; Gondal, MA; Shirokof, J**

**ASM INTERNATIONAL, JOURNAL OF MATERIALS ENGINEERING AND  
PERFORMANCE; pp: 47-54; Vol: 13**

King Fahd University of Petroleum & Minerals

**<http://www.kfupm.edu.sa>**

## **Summary**

Laser shock processing is a good candidate for surface industry due to its rapid processing, localized ablation, and precision of operation. In the current study, laser shock processing of steel was considered. The numerical solutions for temperature rise and recoil pressure development across the interface of the ablating front and solid are presented. The propagation of elastic-plastic waves in the solid due to recoil pressure loading at the surface is analyzed and numerical solution for the wave propagation was obtained. An experiment was conducted to ablate the steel surfaces for shock processing. Scanning electron microscopy was carried out to examine the ablated surfaces shock processing while transmission electron microscopy was conducted to obtain dislocation densities after the shock processing. It was found that surface hardness of the workpiece increased in the order of 1.8 times of the base material hardness, and the dislocation was the main source of the shock hardening in the region affected by laser shock processing.

## **References:**

1. CHU JP, 1999, MAT SCI ENG A-STRUCT, V260, P260
2. DARQUEY P, 1989, THESIS U POITIERS FR
3. FREITAS M, 1993, MAT SCI ENG A-STRUCT, V167, P115
4. GERLAND M, 1992, MAT SCI ENG A-STRUCT, V156, P175
5. GUDONOV SK, 1959, MAT SBORNIK, V1, P271
6. MIHAC T, 1990, VACUUM, V40, P139
7. PEYRE P, 1995, OPT QUANT ELECTRON, V27, P1213
8. PEYRE P, 1996, J LASER APPL, V8, P135
9. SMITH GD, 1985, NUMERICAL SOLUTION P
10. XIAO L, 1996, NUMERICAL COMPUTATIO
11. YILBAS BS, 1995, INT J MACH TOOL MANU, V35, P1047

12. YILBAS BS, 1997, J PHYS D APPL PHYS, V30, P1996
13. YILBAS BS, 1998, P I MECH ENG C-J MEC, V212, P141

For pre-prints please write to: [bsyilbas@kfupm.edu.sa](mailto:bsyilbas@kfupm.edu.sa)