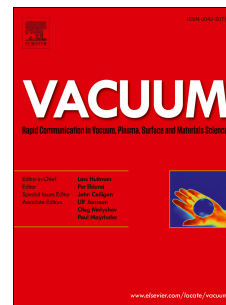


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Surface nanocrystallization and gradient microstructural evolutions in the surface layers of 321 stainless steel alloy treated via severe shot peening

Sadegh Pour-Ali, Ali-Reza Kiani-Rashid, Abolfazl Babakhani



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1 **Surface nanocrystallization and gradient microstructural evolutions in the surface layers of**  
2 **321 stainless steel alloy treated via severe shot peening**

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4 Sadegh Pour-Ali, Ali-Reza Kiani-Rashid\*, Abolfazl Babakhani

5 Materials and Metallurgical Engineering Department, Faculty of Engineering,

6 Ferdowsi University of Mashhad, Postal code 91775-1111, Mashhad, Iran

7 \* Corresponding author email: kianirashid@um.ac.ir

8 Tel: (+98) (51) (38763305)

9  
10 **Abstract**

11 The gradient nanocrystalline structure from the top surface to the subsurface layers of 321  
12 austenitic stainless steel alloy was fabricated by means of severe shot peening. The  
13 microstructural evolutions including the grain size distribution and phase transformation were  
14 investigated in-depth. Experimental results showed that the dislocation slipping plays a key role  
15 in the grain refinement of this alloy and depend on the amount of imparted plastic strain,  
16 different structures including dislocation walls, dislocation tangles, mechanical twinning,  
17 lamella-shaped cells are sequentially appeared in the surface and/or subsurface grains. Due to  
18 imparting ultrahigh plastic deformation in the topmost surface, mentioned structures are  
19 converted to the nano-grains (68-82 nm) to minimize the total energy of the surface layer. In line  
20 with the grain refinement, austenite to strain induced martensite phase transformation is more  
21 affected as the plastic strain increases so that the volume fraction of latter phase reaches to 65%  
22 in the topmost surface. As a result of these evolutions, microhardness values are decreased from  
23 281 to 120 HV in the surface layers.

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