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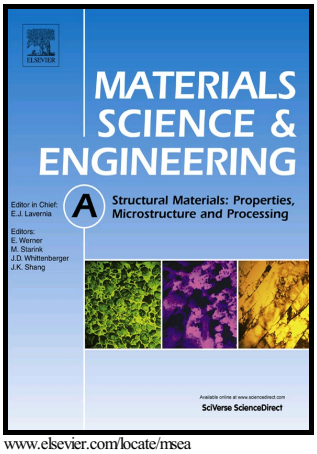

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PII: S0921-5093(17)31639-8
DOI: https://doi.org/10.1016/j.msea.2017.12.042
Reference: MSA35884

To appear in: *Materials Science & Engineering A*

Received date: 24 November 2017
Revised date: 9 December 2017
Accepted date: 11 December 2017

Cite this article as: Zahid Hussain, Fahad A. Al-Mufadi, Sivasankaran Subbarayan and Osama M. Irfan, Microstructure and Mechanical Properties Investigation on Nanostructured Nickel 200 Alloy Using Multi-Axial Forging, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2017.12.042

Microstructure and Mechanical Properties Investigation on Nanostructured Nickel 200 Alloy Using Multi-Axial Forging

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Abstract: Multiaxial Forging (MAF) is one of the novel severe plastic deformation techniques, which can be used to produce nanostructured materials in large-scale production. This process is a simple one as it is not necessary to use special tooling. The present goal of this research work is to manufacture nanostructured Ni 200 alloy using the multiaxial forging process at room temperature. The microstructural examination using various microscopes and mechanical properties evolution due to the variation of the number of cycle of forging (4 cycles) was investigated. The observed results explained that the grain size of Ni 200 alloy was decreased significantly due to grain refinement. The rate of shifting of the microstructure to ultrafine and Nano regimes was variable as it was remarkable after the first cycle of MAF and reduced significantly in subsequent cycles. The average grain size after the third cycle was 220 nm. The results of uniaxial compression and hardness tests indicated a considerable increase in strength and hardness.

Keywords: Ni alloy; severe plastic deformation; multiaxial forging; grain refinement; mechanical properties; hardness.

1.0 Introduction

Recently, severe plastic deformation (SPD) technique [1-4] can be used to enhance the mechanical properties of materials. SPD refers to various metal forming techniques that can impose high strains on metals and alloys in such a way that overall dimensions before and after forming, are almost same [5-10]. For this, special tool geometries are required to form materials to the desired shape by preventing them flowing freely [1]. This method is used to increase the strength of lightweight materials to an extent, which is not possible with other thermo-mechanical processing methods [2]. Ultrafine and Nano grained materials can be produced by