

## Abstract

In this work, open-cell nickel foam was fabricated by electroplating method on polymeric foam. Then, the as-plated foams were exposed to an inert sintering atmosphere at 600, 800 and, 1000°C. The optical microscopic photos from etched samples showed that the microstructure is remarkably affected by sintering temperature. The microstructure of sintered foams at 800 and 1000°C illustrate some sub-boundaries. Microhardness results reveal that the lowest hardness belongs to the sintered specimen at 600°C. By increasing the heat treatment temperature, the microhardness increases as well so that the hardness reaches to that of as-plated foam. This is due to the effect of annealing twins on mechanical properties.

## Introduction

Nickel foams are widely used in various industries due to their unique properties. Commercial methods to fabricate nickel foams are the chemical vapor deposition (CVD) and electrodeposition on a porous organic foam substrate followed by removal of the polymeric substrate. [1,2]

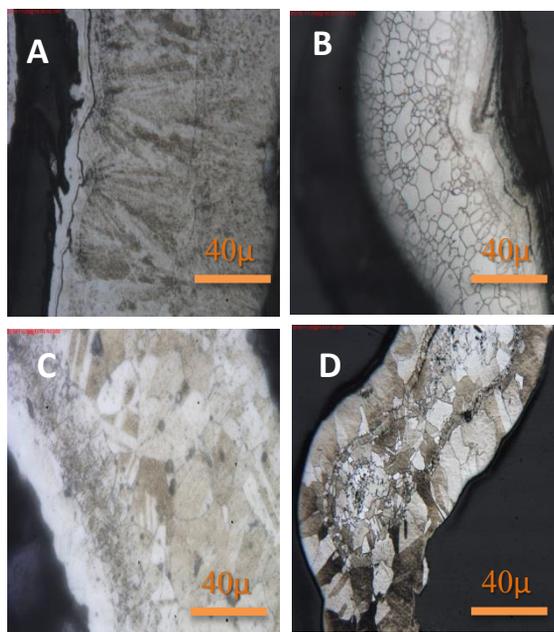
In this work, nickel foams fabricated by the electroplating technique were sintered in a neutral atmosphere in order to evaporate substrate and to enhance ductility. The effect of sintering temperature on the microstructure and microhardness was investigated.

## Experimental

Polyurethane sponge was used as substrate to prepare nickel foam. Firstly, substrate was made conductive using the conventional nickel electroless. Then, the conducted specimens were electrodeposited in Watts bath with current density of about 0.1 A/dm<sup>2</sup>. The electroplated nickel foams were directly sintered in an inert-controlled atmosphere (under the 99.999 Ar gas blow). The samples were heat treated at 600 °C, 800 °C, and 1000 °C for 30 minutes.

## Result and discussion

The studied samples were etched by Marble etchant. The optical images from microstructure of specimens are shown in figure 1. As can be seen the microstructure of as-plated sample is explosively columnar which makes internal stress. Recrystallization and grain growth occurred for all sintered samples. In addition, the microstructure of sintered foams at 800 and 1000°C illustrate some sub-boundaries. These sub-boundaries could be attributed to the formation of annealing twins during grain growth [3].



**Fig.1** the optical images of etched samples, A) as-plated, sintered at B) 600 °C, C) 800 °C, and D) 1000 °C.

Microhardness results reveal that the lowest hardness belongs to the sintered specimen at 600°C. By increasing the heat treatment temperature, the microhardness increases as well so that the hardness reaches to that of as-plated foam. This is due to the effect of annealing twins on mechanical properties.

## References

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- [2] P. Liu and K. Liang: Mater. Sci. Technol., 2000, vol. 16, pp. 575–78.
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Sample	As-plated	Sintered at 600	Sintered at 800	Sintered at 1000
Microhardness (HV)	185±23	105±9	153±15	174±6