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# Effect of Cu on microstructure evolution and mechanical properties of Fe-Nb dissimilar welds

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## ABSTRACT

In this paper, we report a thorough study of phase formation in Fe-Nb weld metals using a combination of microscopy and composition analysis. The correlation of microstructure and mechanical properties was established by nanoindentation. A simplified scenario of weld formation was proposed. Nb weld metal was dominated by the coarse Laves phase ( $\text{Fe}_2\text{Nb}$ ) with high hardness ( $\sim 20.4\text{GPa}$ ). With the addition of Cu, sound weld metal was obtained with alternative distribution of  $\alpha\text{-Fe}$ , Cu phases and fine eutectic phases ( $\alpha\text{-Fe}+\text{Fe}_2\text{Nb}$ ). These transformation products with lower hardness ( $\alpha\text{-Fe}+\text{Fe}_2\text{Nb}\sim 11.6\text{GPa}$ ) improved the overall mechanical properties of the weld metal.

**Keywords:** Microstructure; Intermetallics; Phase transformation; Nanoindentation.

## 1. Introduction

Welding of dissimilar materials is continuously attracting attention by the industry because of its potential benefits on increasing design flexibility and reducing cost [1]. Niobium (Nb) is a refractory metal which has many desirable properties that make them suitable for numerous engineering applications [2]. The Fe-Nb binary phase

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