Alternate Eutectic Systems for Aluminum Casting Alloys

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INTRODUCTION

The objective of this work is to explore eutectic systems other than aluminum-silicon for use in aluminum casting alloys. These alternate eutectics should be such that the resulting alloys are more useful in high temperature applications than traditional aluminum alloys. For decades, the aluminum-silicon eutectic has been used in commercial casting alloys because it enhances the casting characteristics of aluminum. However, the melting temperature of this eutectic is only 577°C. The alternate eutectics that will be investigated are Al-Fe and Al-Ni, which melt at 650°C and 640°C, respectively; together with the ternary Al-Fe-Ni eutectic. These eutectic systems are selected for investigation because of their relatively high melting temperature, and because they form a stable intermetallic phase (Al_xFe, Al_3Ni, $AlxFe_yNi_z$) with eutectic aluminum.

METHODOLOGY

The research effort is divided into three main Tasks:

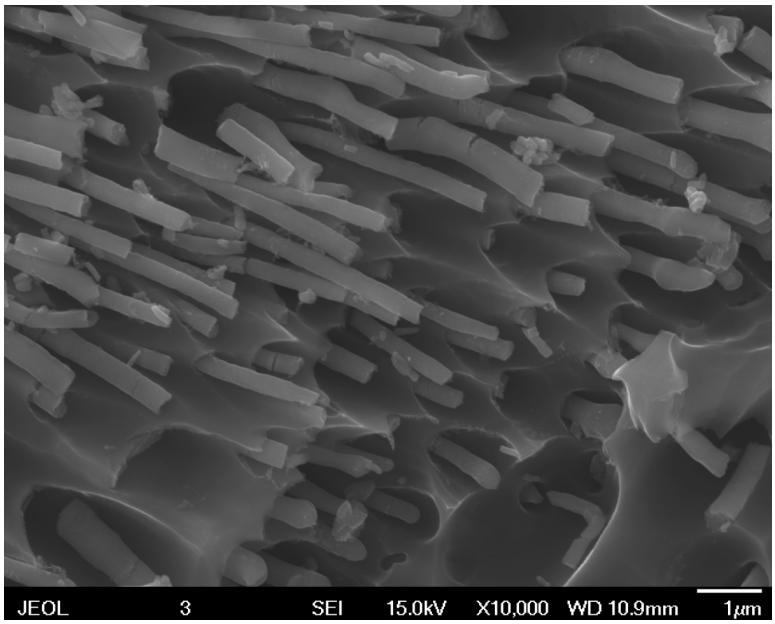
1. Investigating the binary Al-Fe eutectic system
   - 1.1 Perform a literature review and a detailed investigation of Al-Fe eutectic system
   - 1.2 Investigate the possibility of modifying the shape of the Al_xFe phase by chemical additives
   - 1.3 Investigate the possibility of modifying the shape of the AlxFe phase by chemical additives

2. Investigating the binary Al-Ni eutectic system
   - 2.1 Perform a literature review and a detailed investigation of Al-Fe eutectic system
   - 2.2 Investigate the possibility of modifying the shape of the Al_xFe phase by chemical additives
   - 2.3 Investigate the possibility of modifying the shape of the AlxFe phase by chemical additives

3. Investigating the ternary Al-Fe-Ni eutectic system
   - 3.1 Perform a literature review and a detailed investigation of Al-Fe eutectic system

3.2 Investigate the possibility of modifying the shape of the Al_xFe phase by chemical additives

3.3 Investigate the possibility of modifying the shape of the AlxFe phase by chemical additives



SEM image showing the Al-Ni eutectic; the sample was deep-etched in order to reveal the rod-like Al_3Ni phase of the eutectic.