

Research Programs

Improving Aluminum Casting Alloy and Process Competitiveness

Research Team:

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Introduction

The continuing quest for aluminum castings with enhanced properties at a competitive price for applications in the automotive and aerospace industries is the motivation for this project. Over the past decade, one of the research emphases at ACRC has been to understand the evolution of microstructure in aluminum casting alloys. Along these lines, we have developed a thorough understanding of the formation of the Al-Si eutectic phases in aluminum alloys. An over-riding research effort at ACRC has always been to understand the nuances of the various casting processes. For example, we have developed a thorough understanding of the die-soldering phenomenon in die-casting. The goal of this project is to build on our previous work to optimize the composition of aluminum alloys and improve casting processes to enable production of quality, cost-competitive aluminum alloy castings. The objective is to obtain a new family of aluminum-silicon alloys that is die-castable at significantly lower than usual temperatures, and therefore is cost-effective; and that is heat-treatable, and therefore is capable of significantly higher than typical mechanical properties.

The project is divided into three phases as follows:

Phase 1

Phase 1 concentrates on developing a new family of aluminum-silicon alloys that is castable at significantly lower than usual temperatures, and therefore are cost-effective; and that is heat-treatable, and therefore is capable of significantly higher than typical mechanical properties. Within the context of Phase 1 is the development of an optimum heat treatment schedule for the new alloy system.

Phase 2

Phase 2 focuses on adapting the alloy system developed in Phase 1 to the die-casting process. The underlying premise is that die-casting at sufficiently low temperatures will cause negligible soldering of the alloy to the die. Accordingly, much lower iron content than that which is typical to die casting alloys will be required in the new alloy system, thus allowing significantly higher than typical mechanical properties to be attained.

Phase 3

Phase 3 explores the possibility of heat-treating die cast samples of the new alloys to further enhance their performance characteristics. Within the context of Phase 3 is measurement and documentation of the mechanical properties of heat-treated, die-cast samples.