

Research Programs

Slurry-Ready SSM: The Continuous Rheoconversion Process (CRP)

Research Team:

Qingyue Pan
Diran Apelian

Introduction

The Continuous Rheoconversion Process (CRP) is a novel slurry-on-demand process that was developed by the research team. The process is based on a passive liquid mixing technique in which the nucleation and growth of the primary phase are controlled using a specially designed "reactor". The reactor provides heat extraction, copious nucleation, and forced convection during the initial stage of solidification, thus leading to the formation of globular structures. The advantages of the CRP process include:

- Continuous conversion of liquid to slurry
- Flexible
 - Thixocasting or slurry-ready
 - Not alloy specific
- Allows for rapid adjustment of solid content
- Recycling of scrap easy to incorporate
- Can be used with one melt as well - design flexibility
- The CRP can accommodate significantly higher levels of superheat than existing slurry-on-demand processes
- Commercially viable - patent application submitted and in process

The objective of this project is to optimize/simplify the process for commercial applications. Specifically, to retrofit most die casting facilities, the CRP reactor has been optimized and simplified in such a way that only one melt is involved wherein both nucleation and mixing takes place simultaneously within the reactor. Moreover, to enhance the control of melt nucleation and to conveniently adjust slurry fraction solid, an optimized cooling system is incorporated into the reactor. Figure 1 illustrates the concept for the scaleup of the CRP process for commercial applications.

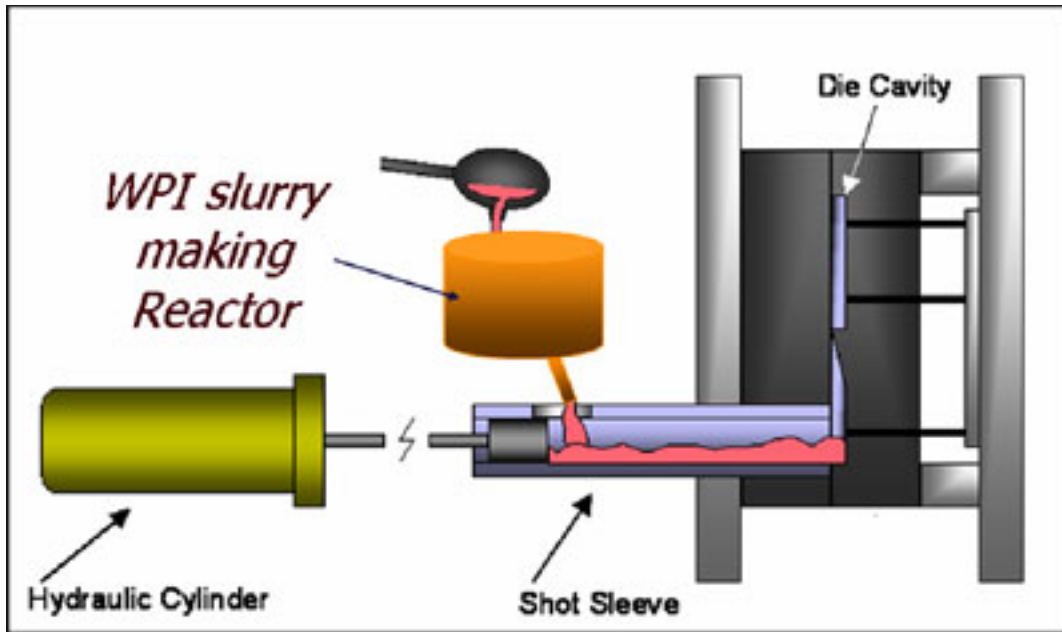


Figure 1: CRP concept implemented within a typical die casting setting

Recently, numerous CRP industrial Beta trials have been conducted successfully with the assistance of ACRC Consortium Members. Figure 2 illustrates typical settings of an optimized/simplified CRP reactor in a horizontal die casting machine, and a vertical die casting machine, respectively. Sound SSM castings (casting weight: 5-10 kg) such as camshaft housings, steering control arms etc have been cast using several commercial alloys such as A356, Silafont 36, 319, 206 etc. Figures 3 and 4 show some SSM castings and microstructures obtained from the industrial Beta trials.



Figure 2: Showing the CRP reactor attached to a horizontal die casting machine (a), and a vertical die casting machine (b).



Figure 3: SSM castings processed via CRP

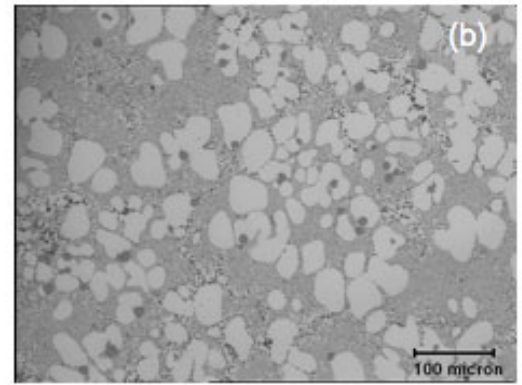
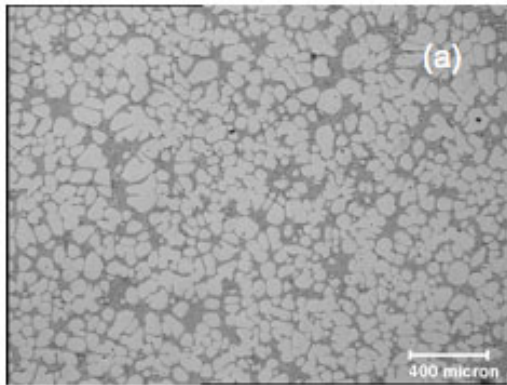


Figure 4: Typical microstructures of SSM castings processed via CRP: (a) 356 alloy (not grain refined) and (b) Silafont 36 (not grain refined).

SSM Related Publications (2002-Present)

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