



USC Merwyn C. Gill Foundation
Composites Center

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Steel Foam Synthesis from Liquid State

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Background and Motivation:

Metallic foams are a class of new materials that are used mostly in applications that require light weight and good energy absorption components. Besides being ultra-light structures, they also can have a multifunctional role in heat dissipation, vibration control and noise control.

Aluminum is the metal mostly used for producing metal foams and there are many methods available for producing aluminum foams. But, cost is the main obstacle to the use of aluminum foam as light-weight structural material. Steel foam has already been developed by powder metallurgy approach at USC by Prof. Nutt. The powder metallurgy approach is more costly compared to a liquid state method, that is one of the reasons for trying to implement a cheaper method of synthesis of steel foams. Finally, producing steel foams presents many challenges compared to aluminum foams because of the higher melting temperature of steel compared to aluminum.



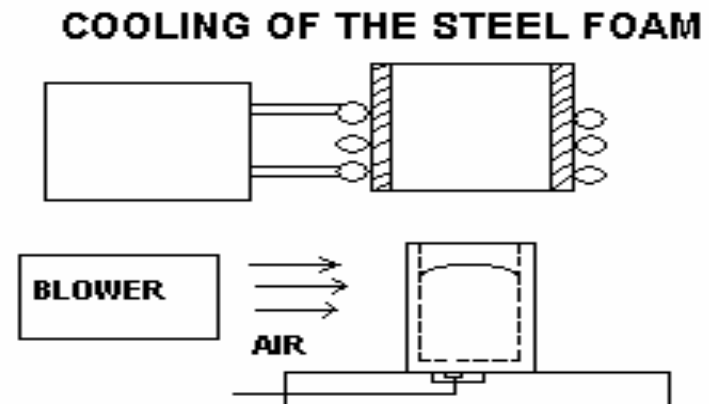
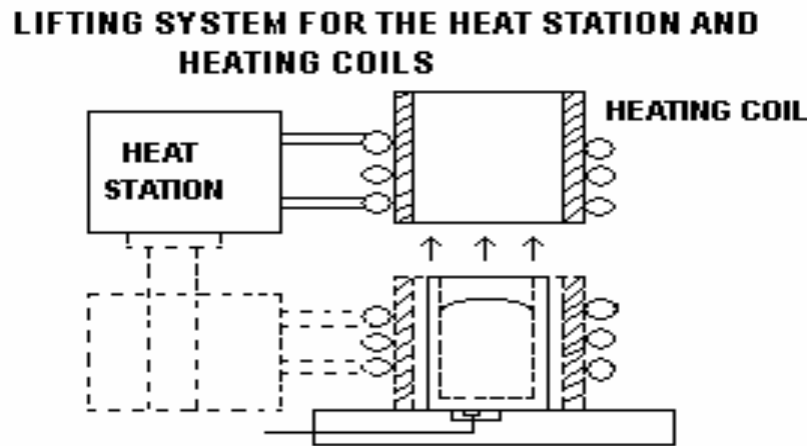
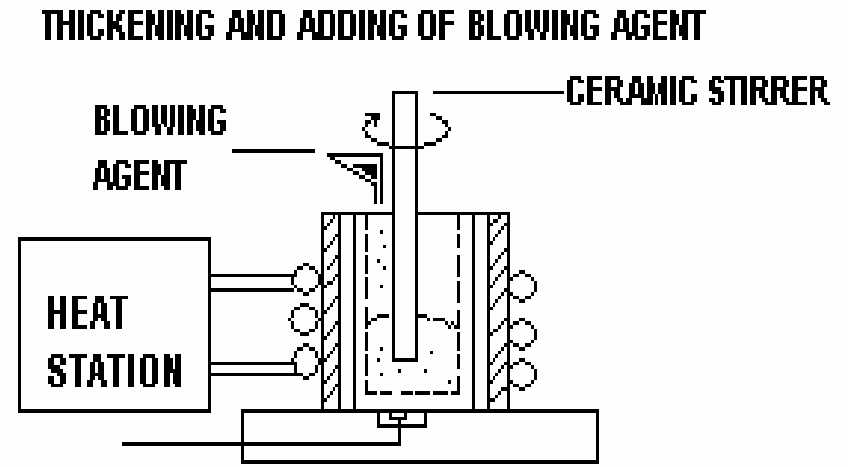
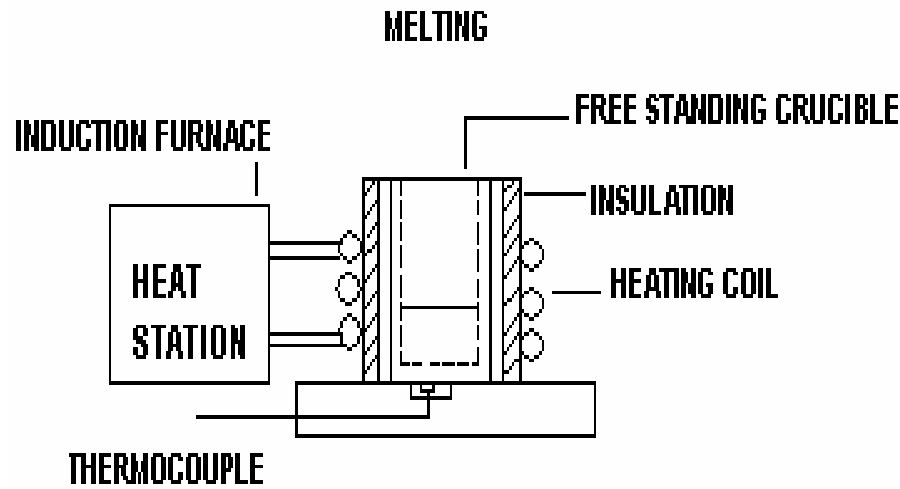
Objectives:

The problem addressed in the project is the development of a method for the synthesis of steel foams from liquid state. The proposed solution is the transference of the existing technology for the manufacturing of aluminum foams to make the steel foams. This effort will include the modification of the parameters of the process, equipment, blowing agents, etc.

Experiments and Analysis:

Basically, the same steps used in the production of aluminum foams can be used to produce the steel foams, but with some modifications. This process is known as Alporas process and it is already used for the fabrication of aluminum foams.

- Melting of steel.
- Increment of viscosity.
- Adding of the foaming agent.
- Cooling of the foam.
- Foam characterization.



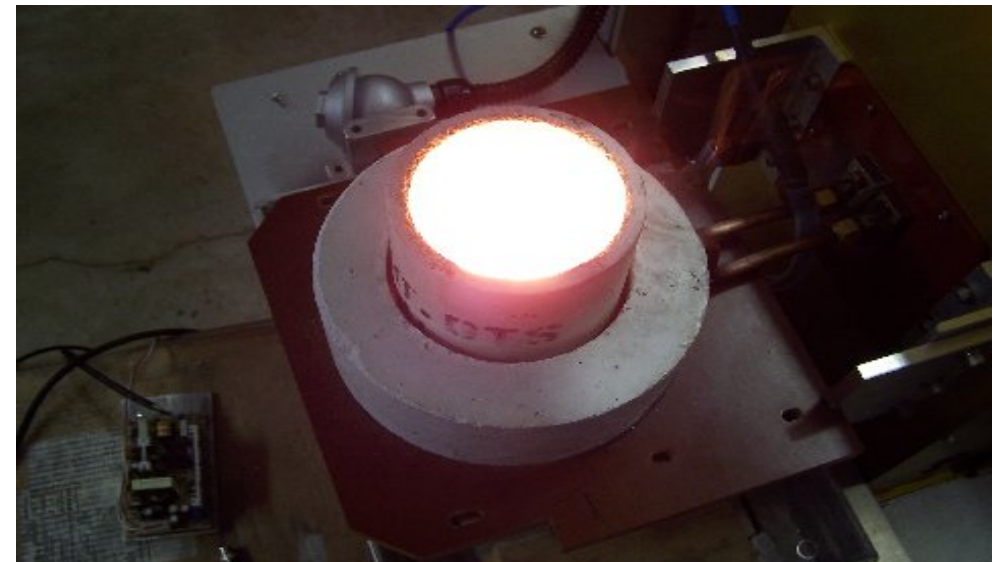
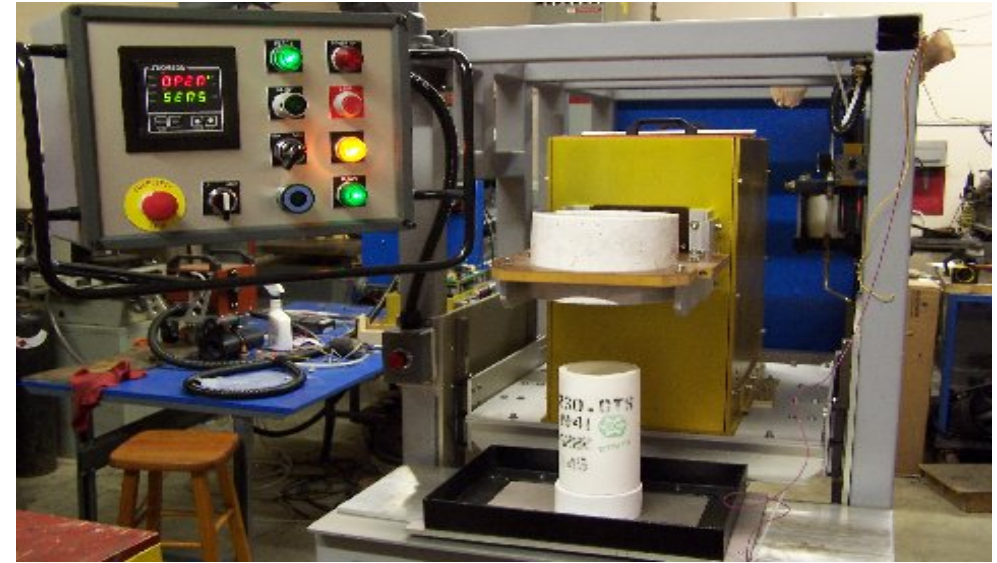
Schematic of steel foam fabrication



Results:

One of the first problems to solve is how to melt the steel. For melting steel, induction furnaces are a good alternative and have some advantages compared to other kind of furnaces: for example temperature control and composition control.

At the this point in the project, a induction furnace supplied by MSI AUTOMATION,Inc. is being tested for melting steel.



Melting of steel in a induction furnace



Conclusions:

- The method that will be used for the synthesis of the steel foams is the direct foaming of the liquid steel.
- Cost is one of the reasons to implement a economical method of synthesis of steel foam by liquid state processing.
- The selection of the parameters used for the development of the steel foam process is very important: melting temperature, amount of blowing agent added, amount of thickening agent, holding time during foaming, etc.