MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1460** Type: **Poster Presentation**

Tue-Af-Po2.23-07 [94]: Design and experimental implementation of a novel electromagnetic stirring system for casting particle-reinforced aluminum matrix composites

Tuesday 24 September 2019 14:00 (2 hours)

Stirring casting is one of the most commonly used fabrication processes for particle-reinforced aluminum matrix composites (PRAMCs). It includes mechanical stirring and electromagnetic stirring. Compared with the former, electromagnetic stirring has advantages of non-contact, flexible force loading and so on. However, the structure of traditional electromagnetic stirrer (EMS) is similar to the stator winding of three-phase asynchronous motor, which is cumbersome and complex. In order to overcome the disadvantages of traditional stirring casting, a novel electromagnetic stirring system consisting of an solenoidal electromagnetic stirrer (SEMS) and a temperature control device is proposed in this paper. SEMS draws lessons from the idea of tube compression in electromagnetic forming. Compared with EMS, the structure of SEMS is quite simple and compact.Only a single coil is required to produce an alternating magnetic field. According to the law of electromagnetic induction, the conductive molten aluminum is subjected to Lorentz force generated by the magnetic field and induced eddy current. The nonuniform distribution of the force causes strong stirring effect, which enables the reinforced particles to distribute evenly in the aluminum matrix. The temperature control device, composed of a resistance furnace, a thermocouple and a control box, is used to keep the aluminum matrix molten.To verify the feasibility of the proposed electromagnetic stirring system, a coupling model of electromagnetic field and flow field is established to study the relationship between the magnetic field strength, frequency and electromagnetic stirring force by numerical analysis. On this basis, the electromagnetic stirring system is fabricated and tested, of which the working coil has 96 turns and an inductance of 5.8mH. The system can provide different magnetic field strength (0˜50mT) and frequency (0˜200Hz) in the region of interest. More importantly, it has been demonstrated that the composite suspension consisting of aluminum and particles can be well stirred under these parameters.

Authors: HAN, Xiaotao (Wuhan National High Magnetic Field Center, Huazhong University of Science and Technology); FU, Junyu (Huazhong University of Science and Technology,Wuhan National High Magnetic Field Center); Mr CHEN, Weilin (Wuhan National High Magnetic Field Center, Huazhong University of Science and Technology); DU, Limeng (Wuhan National High Magnetic Field Center); CAO, Quanliang; Prof. CHEN, Qi (Wuhan National High Magnetic Field Center, Huazhong University of Science and Technology)

Presenter: FU, Junyu (Huazhong University of Science and Technology,Wuhan National High Magnetic Field Center)

Session Classification: Tue-Af-Po2.23 - Novel and Other Applications I