S-12

Ostwald ripening theory on evolution of foamed metal structure

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Foamed metal is usually produced by two methods, powder metallurgy and melt foaming. Especially, the melt foaming method, addition of a foaming agent to the molten metal is useful for the commercial production of foamed aluminum due to the low cost and the wider industrial application.

However this method has a difficulty to produce higher porosity with finer pores because the evolution of pore cannot be avoided during the whole process. In order to control the situation a lot of experimental works and the analysis have been reported already but the theoretical understanding is not sufficient enough.

In this study, at first we introduce Ostwald ripening theory on the pore evolution because gas element like hydrogen can diffuse from one pore to another easily thorough the thinner walls of liquid at high temperature. One of the authors had developed the generalized formula of Ostwald ripening that can be applied not only to particles in solid but also gas pores in liquid. Ostwald ripening is a basic evolution process that larger particles or pores grow and smaller ones shrink so as to decrease the total interfacial energy between matrix and particles or pores. Therefore, if the calculation results of Ostwald ripening for pore evolution in melt are in agreement with experimental results, the theory should be given higher priority than any other like a coalescence theory. We show the good agreement between theory and experiments first.

S-13

Study on Reduction of Iron Scrap Immixed Waste Plastics as Porous Raw Materials for Steelmaking Process

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Plastic is mainly compound of carbon and hydrogen and may include other elements for its special use. Theoretically, almost all kinds of plastics can be used as reductive agent fuel in metallurgical process. Besides, the gasifying of waste plastics at high temperature inevitably forms porosities in the material that is more propitious to using it as a kind of raw material in steelmaking process.

As the beforehand work, a group experiments were arranged to primarily determine the mixed gasifying gas compounds and to analyze the chemical compounds of the tar and semi-coke from the gasifying of waste plastics.

Besides, a new way for using waste plastics in Direct Reduction Iron process was put forward in a project application to the National Natural Science Foundation of China in 2002. Since then, the reductive system of iron scrap that is a kind of porous gas-solid reaction has being been investigated by immixing waste plastics into the iron scrap reduction column. The experimental results show that inner reducing agents as well as good porosity in the reduction column by immixing waste plastics into the iron scrap profit systematic heat transfer, gas diffusion and interfacial chemical reaction.