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1. Main Research Results

- 1) Radiative heat transfer reduction across mould flux for continuous casting by its crystallization

In continuous casting, the mould flux existing between the shell and the mould plays important roles in infiltration of the shell and heat extraction from the shell. High speed continuous casting requires slow cooling, which has been achieved by crystallisation of mould fluxes: namely, crystallisation of mould flux enhances the reflectivity and decreases the transmissivity, leading to reduce radiative heat flux reduction from the shell to the mould. In this study, it has been found that crystallisation of iron oxide free flux is more effective for reducing the radiative heat flux. In addition, it has been suggested that there be a possibility of optimal crystal grain size existing for slow cooling,

- 2) Measurements of emissivities for molten Fe-C alloys

Emissivities of solid Fe – x mass% C alloys ($x = 0 - 1$) have been measured at temperatures between 1173 and 1673 K in the wavelength ranges 500 – 1000 nm and 1400 – 2500 nm. The measured normal spectral emissivities show no significant dependence on temperature and carbon concentration; in contrast, they increase with decreasing wavelength. The emissivity of steels at 1600 nm, at which the strongest radiation occurs in the continuous casting condition, has been determined to be about 0.3.

- 3) Measurements of electric resistivities for molten Ge-Sb-Te alloys

Electric resistivities for the Sb-Te binary system and Sb_2Te_3 -GeTe pseudo-binary system have been measured to find a phase change material (PCM) applicable to phase change random access memory. The electric resistivities measured show negative temperature dependence in the temperature range from its melting point to 1000 K with good reproducibility. The electric resistivity differences between the crystals and the liquids at the corresponding liquidus temperatures suggest that $Ge_2Sb_2Te_5$ is the most suitable material for PCM.

2. List of Publications

- 1) "Effects of Both Crystallisation and Iron Oxides on the Radiative Heat Transfer in Mould Fluxes", Masahiro Susa, Atsushi Kushimoto, Hiroaki Toyota, Miyuki Hayashi, Rie Endo, Yoshinao Kobayashi, ISIJ International, 49 (2009) 1722-1729.
- 2) "Reduction Kinetics of Iron Oxides in Molten Lunar Soil Simulant by Graphite", Yoshinao Kobayashi, Hiroaki Sonezaki, Rie Endo, Masahiro Susa, ISIJ International, 50 (2010) 35-43.
- 3) "Electric Resistivity Measurements of Sb_2Te_3 and $Ge_2Sb_2Te_5$ Melts Using Four Terminal Method" Rie Endo, Simpei Maeda, Yuri Jinnai, Rui Lan, Masashi Kuwahara, Yoshinao Kobayashi, Masahiro Susa, Jpn. J. App. Phys. (in press)

3. Invited/Plenary Talks in Conference

"Electric Resistivities of Liquid Sb_2Te_3 and $Ge_2Sb_2Te_5$ " R Endo, S Maeda, Y Jinnai, M Kuwahara, Y Kobayashi, M Susa, European Phase Change and Ovonic Symposium (Aachen, Germany, Sep. 2009), Proceedings of European Phase Change and Ovonic Symposium 2009. pp. 64-67.

4. International Collaboration

Collaborative Work with Corus, The Netherlands