

かき殻モルタルの圧縮強度に及ぼす高炉スラグ混合セメントの影響
**Effects of Ground Granulated Blast Furnace Slag on Mechanical Properties of Oyster
Shell Aggregate Mortar**

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ABSTRACT

This study was an attempt to investigate the effect of slag content on the compressive strength of river sand (RS) and oyster shell aggregate (OS) mortar in different aspects; fineness of slag, different percentage of slag content, cement types and use of chemical admixture (super plasticizer). Compressive strength of moist cured specimen was measured at 3, 7, 28, 91 days. Slag could be used up to 85% in partial replacement of cement and 75% slag content will give the highest strength for OS mortar. The compressive strength of RS-slag mortar could be lowered at initial stage but finally will increase about 17% than that of no slag mortar. OS mortar strength increased by adding chemical admixture with or without slag condition. Oyster shell aggregate could be used as fine aggregate and slag could be added with it to increase the compressive strength.

INTRODUCTION

To protect the global environment, there are growing demands from environmental organizations` in the world for recycling the construction materials, minerals and other ingredients to reduce environmental hazards. Researchers` are trying to increase the use of slag products in the construction industry not only as replacements for natural resources, but also as sustainable construction works.

Replacing Portland cement with slag cement in concrete can save up to 59% of the embodied CO₂ emissions and 42% of the embodied energy required to manufacture concrete and its constituent materials (World Steel Association, 2010).

Objectives of this paper is to investigate the effect of slag content in mortar as a partial replacement of cement, to determine the optimum percentage of slag for sand and oyster shell (OS) mortar and to find out the specific effect of slag in sand and OS mortar.

MATERIALS AND METHODS

The investigation was accomplished with ordinary Portland cement, oyster shell aggregate, super-plasticizer and ground granulated blast furnace slag (GGBFS). All the materials were collected from local market in Mie prefectural area in Japan. Mortar was prepared by different experiment materials with design mixing proportion. Cylindrical samples were prepared from mortar for the experiment with 50 mm diameter and 100 mm height. As slag was used as partial replacement of cement; cement and slag together was named as “Binder” in this study.

Three cylindrical samples were used for each age of curing. Samples produced from study aggregates were demoulded after three days, then, cured in water with 18 - 20°C at 20°C room temperature, until the samples were used for compressive strength measurement at 3, 7, 28 and 91 days. Compressive strength of each

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specimen was determined using universal testing machine with JIS A 1108.

RESULTS

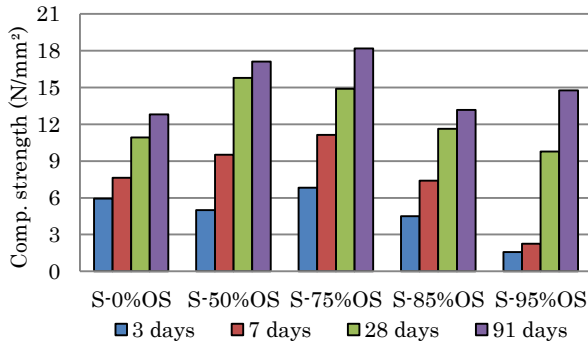


Fig.2 Primary effect of slag (S-40)

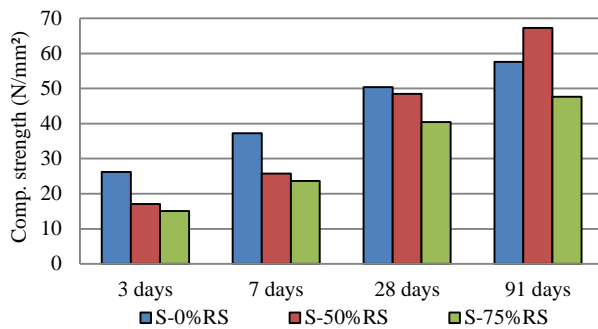


Fig.4 Effect of slag on RS mortar

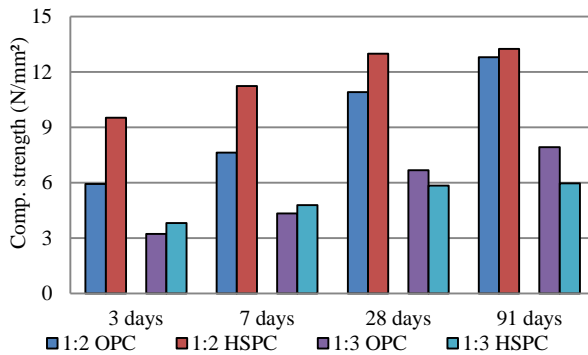


Fig.7 Effect of cement types on OS mortar

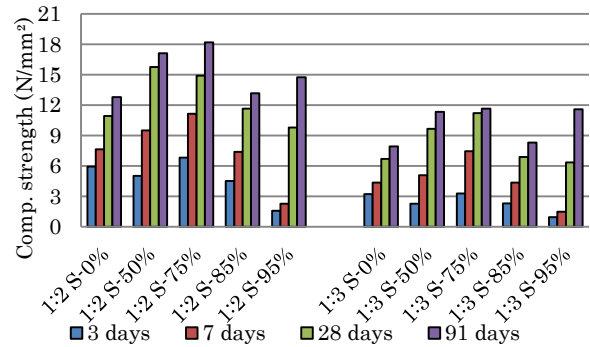


Fig.3 effect of different percentage of slag

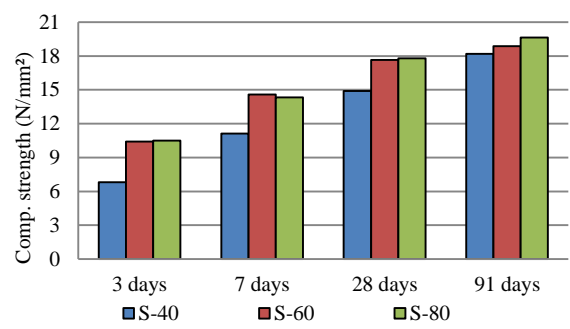


Fig.6 Effect of the fineness of slag

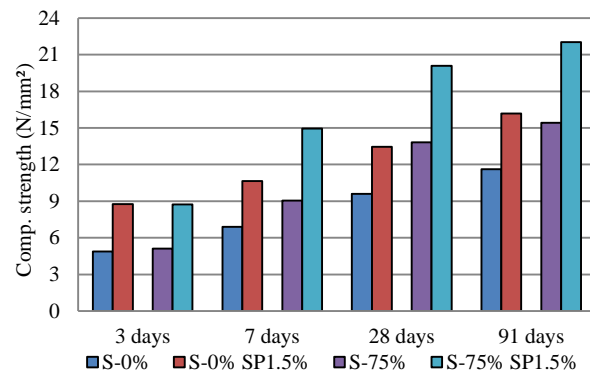


Fig.9 Effect of Super plasticizer

CONCLUSION

Oyster shell aggregate has negative impact on strength of mortar as fine aggregate in compare with sand. The strength reduction due to the use of oyster shell aggregate for preparing mortar in replacement of sand could be reduced up to 20% by using slag in partial replacement of cement and the best result could be achieve by using 75% slag with 1:2 mixing ratio.

REFERENCES

[1] World Steel Association (2010): Fact Sheet on by-products, <http://www.worldsteel.org/publications/fact-sheets/content/01/text_files/file/document/Fact_By-products_2014.pdf>