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【Research Activities】**Development of Ultra-high Temperature Heat Resistant Properties of Mo-Si-B Based Alloys by 4th Element Additions**

The effect of Al addition on high temperature strength and oxidation resistance of Mo/Mo₅SiB₂ in-situ composites had been investigated to improve their ultra-high temperature performance. In this study, it had been found that the Al addition at 3mol% improves high temperature oxidation resistance of the composites without degrading its excellent high temperature strength.

Point Defect and Nanostructure Controlling in B2-type Intermetallics

Several B2-type intermetallic compounds such as FeAl, NiAl, CoAl, TiCo and TiFe were produced by rapid solidification and the changes in their lattice parameters had been examined. In all of the compounds examined, distinctive increases in the lattice parameter had been confirmed, indicating that numerous numbers of supersaturated vacancies were frozen-in during the rapid solidification process. After an aging heat treatment, it was found in CoAl that a large number of nano-scaled superfine pores of 2 - 10 nm in diameter were homogeneously formed inside (**Ref. 1, 2**). On the other hand, vacancy condensation and surface oxidation behavior in FeAl had been investigated using single crystals. In this study, it had been found that nanopores having specific shapes are formed near surfaces depending on surface orientation and pore size can be controlled into less than 10 nm by controlling initial supersaturated vacancy concentration and aging heat treatment conditions (**Ref. 3**). Furthermore, it had been found that the thickness of oxide layer formed during the aging heat treatment is almost comparable to that of passive film formed at room temperature (**Ref. 4**).

Deformation and Fracture of Bulk Metallic Glasses

A Zr₆₅Al_{7.5}Ni₁₀Pd_{17.5} bulk metallic glass, which shows extensive deformation to study its strength, elongation, shear band morphology, fractography and etc. at room temperature in compression, have been investigated by tensile tests at room temperature. In this study, it had been found out that the Zr₆₅Al_{7.5}Ni₁₀Pd_{17.5} bulk metallic glass shows a small amount of plastic strain accompanying with shear bands. Moreover, the occurrence of viscous flow without shear band propagation around the edges of fracture surfaces was confirmed by confocal microscopy.

Structural Analysis of Biominerals in Pearl Shells

In order to clarify formation mechanism on nacreous layer in Mabe shell, the stacking structure and orientation distribution of aragonite crystals had been investigated (**Ref.5**). It had been discovered first in the world that nacreous layers with good pearl quality have strong texture that a, b and c axes are oriented, respectively. Furthermore, it had been found that, in nacreous layers with good pearl quality, aragonite crystals are stacked in spiral configurations.

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- 2.** Yoshimi K., Sung M.S., Tsurekawa S., Yamauchi A., Nakamura R., hanada S., Kawahara K.
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Mater. Sci. Forum, 475 - 479 (2005), 849 - 852.
- 3.** Yoshimi K., Kobayashi T., Yamauchi A., Haraguchi T. and Hanada S.
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- 4.** Yamauchi A., Yoshimi K., Haraguchi T. and Hanada S.
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- 5.** Yoshimi K., Shoji M., Ogawa T., Yamauchi A., Naganuma T., Muramoto K. and Hanada S.
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