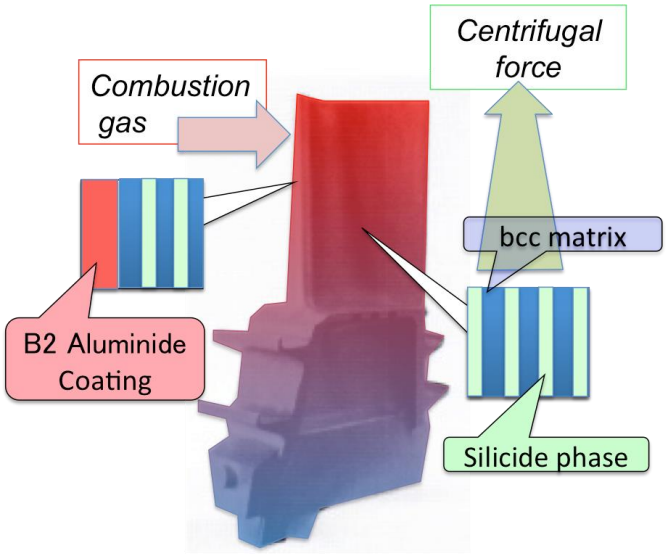
ALLOY DESIGN CONCEPT FOR BCC-T2 SILICIDE-B2 ALUMINIDE MULTICOMPONENT ALLOYS

Seiji Miura, Div. Mat. Sci. and Eng., Hokkaido University, Japan
miura@eng.hokudai.ac.jp
Takuya Yamanouchi, Div. Mat. Sci. and Eng., Hokkaido University, Japan
Nobuhiro Matsuzaki, Div. Mat. Sci. and Eng., Hokkaido University, Japan
Tomonori Soma, Div. Mat. Sci. and Eng., Hokkaido University, Japan
Ken-ichi Ikeda, Div. Mat. Sci. and Eng., Hokkaido University, Japan

Key Words: phase diagram, Laves phase, microstructure control, coating

For the development of refractory metal-based high temperature bcc alloys, the phase equilibrium between bcc (Nb-Mo) and T2 $(Nb, Mo)_5(Si,B)_3$ has been investigated. Bcc matrix phase is for toughening at ambient temperatures, and T2 phase is for strengthening and also for oxidation resistance. However, the oxidation resistance of T2 phase is still under investigation. B2-NiAl phase has been utilized as coating materials for Ni-based superalloys for many years. However, addition of Al and transition metal element such as Ni and Fe results in the formation of brittle Laves phases in refractory metal-based bcc alloys.



In the present study it is found that additive element selection in terms of atomic size control is effective to avoid the formation of Laves phase. From this phase stability viewpoint, a three-phase alloy composed of Nb, Mo, Si, B, Ni and Al is proposed as a first step for designing three-phase alloys.

This work was supported by the JST-ALCA program, Ultra Heat- Resistant Materials and High Quality Recycled Steel, High temperature materials based on multi-element bcc solid solutions.

Figure 1: Needs and selection of phases for high temperature application.