

Development of Ti-base high-temperature functional structure materials



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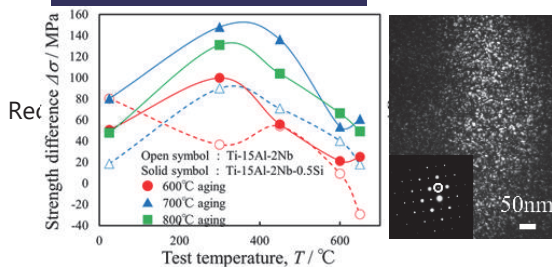
Background

- To improve efficiency of jet engine, a breakthrough to improve creep and oxidation resistance is important. High-temperature shape memory alloys (SMA) are also expected to improve efficiency, but development of candidate materials is necessary.

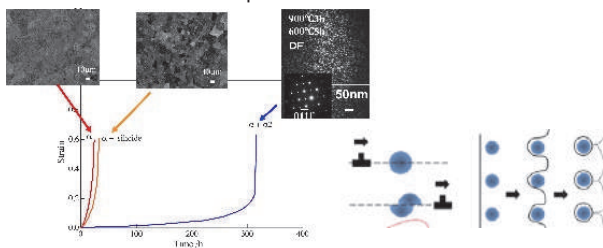
Aim

- Alloy design by understanding of processing and microstructure on creep and fatigue of Ti alloys together with improvement of oxidation resistance.
- Alloy design by improvement of high temperature strength and development of SMA which can be used around 500 °C.

High temperature Ti alloys



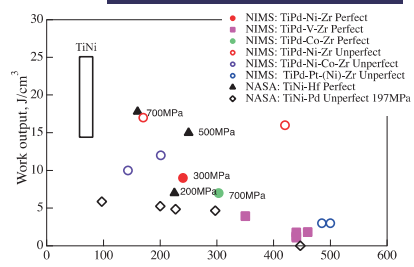
The effect of precipitation hardening was clarified from complex microstructure of Ti



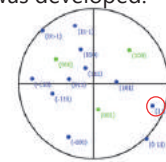
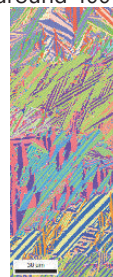
The effect of each microstructure factor on creep was clarified. New alloys is designed using the effect of microstructure.

Advanced Research Topics

High temperature SMA



By combination of elements which have high solid solution hardening, new alloys which indicate large work output as same as that of TiNi around 400 °C was developed.



Alloy design by microstructure controlling has been performed.

Publications

- Y. Yamabe-Mitarai et al., Shape memory and superelasticity, 3, 4 (2017) 381-391.
- H. Sato, Y. Yamabe-mitarai et al., Mater. Trans. 58, 10 (2017) 1479-1486.
- K. Shimagami, Y. Yamabe-Mitarai et al., Mater. Trans. 58, 10 (2017) 1404-1410.

Summary

- New Ti alloys are developing by clarification of the effect of each microstructure factor.
- Shape memory alloys which will be able to use above 400 °C have been developed using high solid solution hardening effect.

Research outcome

- Development of new Ti alloys with good valance of creep and fatigue by formation of new microstructure by processing control.
- Development of HT-SMAs which show stable work output around 500 °C.