

SULFIDATION PROCESSING AND Cr ADDITION TO IMPROVE OXIDATION
RESISTANCE OF Ti-Al INTERMETALLIC COMPOUNDS AT ELEVATED
TEMPERATURES

Toshio NARITA, Takeshi IZUMI^(*1), Mamoru YATAGAI^(*1),
and Takayuki YOSHIOKA^(*2)

Research Group of Interface Control Engineering, Graduate School of Engineering,
Hokkaido University, 060-8628 Sapporo, JAPAN

(*1) Graduate School of Hokkaido University

(*2) Niigata University, Niigata Japan

Abstract

A novel process is proposed to improve oxidation resistance of Ti-Al intermetallic compounds at elevated temperatures by both Cr addition and pre-sulfidation, where TiAl alloys with/or without Cr addition were sulfidized at 1173K for 86.4ks at a 1.3 Pa sulfur partial pressure in a H₂-H₂S gas mixture. The pre-sulfidation treatment formed a thin Cr-Al alloy layer as well as 7 ~ 10 micrometer TiAl₃ and TiAl₂ layer, due to selective sulfidation of Ti. Oxidation resistance of the pre-sulfidation processed TiAl-4Cr alloy was examined under isothermal and heat cycle conditions between room temperature and 1173K in air. Changes in TiAl₃ into TiAl₂ and then TiAl phases as well as their effect on oxidation behavior were investigated and compared with the oxidation behavior of the TiAl-4Cr alloy as well as TiAl and pre-sulfidation processed TiAl alloys. After oxidation for up to 2.7Ms a protective Al₂O₃ scale was formed, and the pre-formed TiAl₃ changed into TiAl₂ and the Al₂Cr phase changed into a CrAlTi phase between the Al₂O₃ scale and TiAl₂ layer. The pre-sulfidation processed TiAl-4Cr alloy had very good oxidation resistance for longer times, up to 2.7 Ms, in contrast to those observed for the pre-sulfidation processed TiAl alloy where localized oxidation occurred after 810ks and both the TiAl and TiAl-4Cr alloys themselves corroded rapidly from the initial stage of oxidation