Interfacial Phenomenon between
Liquid Titanium and Yttria/Zirconia Composites

Student : Wen-Shao Liao Advisor : Chien-Cheng Lin

Department of Material Science and Engineering
National Chiao Tung University

Abstract

Hot pressed composites with various content of Y_2O_3 and ZrO_2 were reacted with the titanium melt at 1700°C/10min in argon. The microstructure of the reaction interface were characterized using x-ray diffraction (XRD), scanning electron microscopy (SEM), electron probe microanalyzer (EPMA) and analytical transmission electron microscopy (TEM/EDS). The result showed that an obviously diffusive phenomenon occur in the 10vol% Y_2O_3-ZrO2 composite and titanium. The α-Ti(Zr, O) and β'-Ti(Zr, O) formed in the titanium side during cooling down to the room temperature. The β'-Ti(Zr, O) existed due to the dissolution of large amount of Zr which restrained β→α phase transformation. In the ceramic side, large amount of α-Zr was precipitate from ZrO_{2-x}. When the Y_2O_3 content is greater then 30vol%, the diffusive phenomenon was restrained. The liquid titanium can only infiltrated into the ceramic mold through the open pores and grain boundary. The α-Ti(Zr, O) and β'-Ti(Zr, O) formed in the ceramic side in the form of network during cooling down to the room temperature. Precipitation of β'-Ti(Zr, O) in titanium side and α-Zr in ceramic side decrease as the Y_2O_3 content increase. When the Y_2O_3 content is greater then 70vol%, infiltration path of liquid titanium to ceramic side was mostly blocked. When the Y_2O_3 content is greater then 90vol%, there is no interfacial reaction zone between titanium and ceramic composite.