

# "Design, Synthesis and Properties of Titanium Metal Matrix Composites Based on Ti-B-Fe System"

The present study focuses on the design and synthesis of titanium metal matrix composites based on Ti-B-Fe system where the Fe-stabilized beta titanium phase serves as the matrix phase and titanium boride (TiB) serves as the reinforcement phase. One of the principal objectives is to use ternary Calphad calculations to find the optimum processing temperature for Electric-Field-Activated-Sintering. Additionally, microstructures, phases, flexural strength and fracture toughness properties of selected composites have been investigated. In general, the hardness of the composites increase with an increase in the amount of TiB phase. The composite with 30 mol. % of B composition showed a very interesting microstructure in which a uniform distribution of TiB phase ( $V_f = 0.77$ ) separated by  $\beta$ -Ti phase has been formed. The composite exhibits good mechanical properties with good combination of hardness. These hardness levels are 530, 680, and 1080 kg/mm<sup>2</sup>, for volume fraction of boride phases as 0.23, 0.27, and 0.77 respectively. The flexural strength of the composite with the volume fraction of the boride phase as 0.77 was found to be in the range of 556 and 727 MPa. The fracture toughness was found to be moderate, at 10.25 MPa $\sqrt{m}$ . Fractographic analysis revealed that the strength and fracture toughness were limited by the brittle behavior of the  $\beta$ -Ti phase. Additional research is planned to introduce alloying elements for  $\beta$ -Ti phase to enhance ductility and toughness of the composites.

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Ahmed Degnah is a researcher at the National Center for Aeronautical Technology, King Abdulaziz City for Science and Technology (KACST) in Saudi Arabia and he is currently pursuing his PhD on "Design, Synthesis and Properties of Titanium Metal Matrix Composites Based on Ti-B-Fe System" under the supervision of Prof. Chandran in the Department of Metallurgical Engineering, University of Utah. Before starting his PhD, he completed his Masters in Materials Science & Engineering from Rutgers University and Bachelors in Mechanical Engineering from Umm Al Qura University, Saudi Arabia. He is funded by King Abdulaziz City for Science and Technology (KACST) scholarship in his graduate study

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