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# Global research collaboration and international education: Laser metal deposition of varying percent of Ti-6Al-4V + molybdenum on Ti64 substrate for biomedical/aerospace applications

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ABSTRACT:

This paper presents the characterization studies conducted by Milwaukee School of Engineering senior undergraduate students in South Africa under the Research Experiences for Undergraduates grant EEC-1460183 sponsored by the National Science Foundation (Principal Investigator Dr. Kumpaty). Robert Mueller and Christopher Reynolds conducted research in summer of 2015 under advisement of Dr. Kumpaty and his South African collaborators, Dr. Esther Akinlabi and Dr. Sisa Pityana. The foreign collaborators' excellent support was pivotal to the success of our U.S. students. Ti-6 Al-4 V is a titanium alloy that accounts for about 80% of the titanium market. The Ti-64 alloy contains 6 wt% Aluminum and 4 wt% Vanadium, an almost equal ratio of a + ß phases. Through the laser surface modification process known as Laser Meal Deposition, this alloy offers the optimum combination of enhanced properties. This research focuses on the application of adding a combination of molybdenum (Mo) and Ti-64 powders to a Ti-64 substrate surface in order to improve the durability for various biomedical/aerospace applications. Deposition of the powders was completed at the CSIR - National Laser Center, in Pretoria, South Africa. The characterization studies were carried out at the University of Johannesburg. The results of the hardness tests showed that the addition of molybdenum to Ti-64 increased the hardness of the deposited material compared to that of the substrate. This verifies that the addition of Mo to metals can affect the mechanical properties to better suit various applications. While Robert Mueller studied the effect of laser power on the properties of laser metal deposited Ti-6Al-4V + Mo for wear resistance enhancement, Christopher Reynolds investigated scanning velocity influence on the evolving properties of laser metal deposited Ti-6Al-4V + Mo. The results of this promising research and various options for further investigation are presented. The beneficial value of such a global research enterprise on the budding engineers will be apparent and the paper details the process of the international component of the Research Experiences for Undergraduates.