06 ноября 2019 г.

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ADDITIVE MANUFACTURING TECHNOLOGY: LASER MATERIAL PROCESSING AND FUNCTIONALLY GRADED MATERIALS

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УДК: 539.374

DOI: 10.37972/chgpu.2020.44.2.021

Abstract. Professor Akinlabi's research and her team has focused on the field of advanced and modern manufacturing processes like Laser Additive Manufacturing (AM), in particular laser material processing. Her other research work is focused on laser metal deposition and functionally graded materials of titanium-based alloys and other materials. Some of the studies she has been involved in focus on cladding titanium with titanium carbide for enhanced wear properties, the cladding of titanium alloy biological implants with hydroxyapatite (HAP) for improved osteo-integration, and the cladding of Grade 5 titanium alloy with copper for improved corrosion properties for marine applications. Akinlabi focuses her investigations on the development of advanced metallic coatings on Ti-6Al-4V substrate using additive manufacturing technology for improved surface performance; with targeted applications in the aerospace, automotive, and shipbuilding industries. This work makes a substantial contribution to knowledge by bringing the theoretical clarity and experimental studies required for the effective assessment of surface degradation mechanisms in additive manufactured Ti-6Al-4V alloy. This is ascribed to the elimination of high residual stresses and crack formation through the optimization of laser processing parameters, leading to enhanced quality of the coatings, surface adhesion between the substrate and the reinforcement materials, microstructural evolution and thus improved mechanical properties. Her research was developed to produce advanced innovative corrosion-wear resistant coatings with enhanced hardness, tribological property, and sustainable anti-corrosion performance thereby, consequently lengthening the lifespan and durability of titanium and its alloys, eliminating material loss and equipment damage, minimizing cost of maintenance, and reduced failure of this material. Despite all the benefits derived from AM technology, there are still a lot of unresolved issues with the technology that has hindered its performance and commercialisation thereby limiting its application to high tolerant utilizations. Professor Akinlabi research on additive manufacturing techniques had produced near-net-shape, light weight and high strength components which has gradually revolutionized the manufacturing sector. The use of the technology is now providing sustainable production benefits, as ability to repair and manufacture components can now be employed to increase product life circle. Against this background, the Additive Manufacturing technology is in itself referred to as a technology of the future despite its versatile applications in the industry. On the other hand, Functionally Graded Materials (FGMs) are advanced materials usually developed for specific and tailored applications. The FGMs also referred to as materials of the future as its applications are not yet fully explored for tailored applications. In this talk, Prof Akinlabi shared some of her research endeavours in the field of AM and FGMs, and also shared the scope on the primary objectives of the joint project which was to be undertaken on FGM of Titanium alloy and Titanium Carbide.

The study was supported by SA (NRF) / RUSSIA (RFBR) joint science and technology research collaboration (project No. RUSA180527335500/19-51-60001).

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