National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Experimental investigation on ablation and surface behaviour of Z-A against the amalgamation of short pulsed laser and in-situ prepared environments for surface functionalization aspects towards biological performances
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Supervisor	: Prof. Saroj Kumar Patel
Venue	: ME Dept HOD Room
Date and Time	: 19 Aug 2024 (3.30 PM)
Abstract	: Tetragonal zirconia polycrystal-alumina (Z-A) composite behaves differently from other monolithic ceramics when stressed. When it comes to machining this material, laser machining has garnered a significant role compared to any conventional and non-conventional practices. Despite its advantages, some challenges are associated with laser machining while processing thicker substrates, mainly heat accumulation and energy loss after certain passes. The current investigation is divided into four distinct parts to address these challenges. The study compared traditional laser processing with step-down laser processing of thicker Z-A. Secondly, a squircle pattern on Z-A has been fabricated uniquely by laser step-down milling (LSDM) for possible implications as a bone scaffold by considering the effectiveness of laser processing factors (LPFs) namely energy modulation factors and scan controller factors under the disparate states of environments like dry, gas, liquid, and solid. Thirdly, a part of the current research asserts inquisitions for an extensive comparative study by means of ceramography analysis like surface morphology, surface chemistry, quantification of laser-induced cracks and their behavioural patterns, crystal structure, bonding pattern, structural orientation, and polymorphic transformation on laser ablated surfaces (LASs). Lastly, the surface functionalization aspect of LASs was meticulously examined by shedding light on its biological performance through comprehensive *in vitro* assessments, propelling its potential in biomedical applications. A solution that resembles human blood plasma's ionic content and concentration was used to investigate LASs' bioactivity, and wettability. In addition to such investigations Proliferation, metabolic activity and adhesiveness of cell was also examined followed by cell density evaluation. With such contents, the current research stands out with its effective contribution not only in the field of subtractive manufacturing but also in biomedical field by reducing the bridge between manufacturing and biomedical domains under the adoption of unique LSDM within the realm of advanced laser based subtractive manufacturing.