



Turbomachinery component manufacture by application of electrochemical, electro-physical and photonic processes

Fritz Klocke ^{(1) a}, Andreas Klink ^a  , Drazen Veselovac ^a, David Keith Aspinwall ^{(1) b}, Sein Leung Soo ^{(2) b}, Michael Schmidt ^{(3) c}, Johannes Schilp ^d, Gideon Levy ^{(1) e}, Jean-Pierre Kruth ^{(1) f}

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<https://doi.org/10.1016/j.cirp.2014.05.004>

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Abstract

This paper presents an overview of the current technological and economical capabilities of electrochemical (ECM-based), electro-physical (EDM-based) and photonic (Laser-/EBM-based) additive and removal processes for turbomachinery component manufacture. Starting with the industrial demands and challenges of today, the technologies are reviewed in detail regarding achievable geometrical precision and surface integrity as well as material removal and deposition rates for conventionally difficult-to-cut Ti- and Ni-based alloys and dedicated steels. Past, existing and future areas of technology application of these advanced non-mechanical manufacturing processes are discussed. The paper focusses on the description of shaping processes therefore excludes pure welding or coating applications.



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Keywords

Manufacturing; Material Removal; Turbomachinery

1. Introduction

The demand for turbomachinery systems such as aero-engines, stationary gas and steam turbines as well as turbochargers for engines is constantly growing due to the increasing worldwide requirement for energy and mobility. In contrast, conventional energy resources such as oil, gas and coal together with important raw materials are shrinking while environmental pollution due to CO₂ and NO_x emissions is on the rise. Thus, energy and fuel prices as well as costs for environmental protection and sustainability are constantly increasing, necessitating the development and introduction of highly efficient turbomachinery systems.