Development of Hybrid Coating Using Liquid Additive Manufacturing Approach

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Abstract

As global industries increasingly prioritize sustainability and performance, the development of advanced surface coating plays a vital role in achieving greener and more efficient systems. This paper introduces a novel approach through Liquid Additive Manufacturing (LAM) using hybrid materials derived from renewable resources. Specifically, the focus is on hybrid coatings composed of environmentally friendly silicon carbide (eSiC) extracted from rice husk waste, combined with graphene oxide (GO), applied onto titanium alloy material. This hybrid coating not only offers superior tribo-mechanical properties—such as high hardness, wear resistance, and reduced friction—but also addresses circular economy principles by recycling agricultural waste. The LAM approach, with its lower energy and equipment costs compared to conventional methods like CVD or PVD, provides a scalable, industry-friendly solution. This paper highlights the promise of LAM, development steps of hybrid coatings, material performance, and real-world applicability of this

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Author keywords

Additive manufacturing; Circular economy; Hardness; Hybrid coatings; Wear and friction

Indexed keywords

Engineering controlled terms

Additives; Agricultural economics; Agricultural wastes; Circular economy; Coatings; Friction; Graphene; Hybrid materials; Industrial economics; Sustainable development; Titanium alloys; Titanium oxides; Tribology

Engineering uncontrolled terms

Circular economy; Global industry; Hybrid coating; Hybrids material; Liquid additives; Performance; Renewable resource; Rice husk; Surface coatings; Wear and friction

Engineering main heading

Hardness

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