

Brought to you by [INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA](#)

Scopus

[Back](#)

Investigation On the Regression Rate and Structural Integrity for Additively Manufactured Polylactic Acid Nested Skeleton for Hybrid Rocket Motor

[Journal of Aeronautics, Astronautics and Aviation](#) • Article • 2026 •

DOI: 10.6125/JoAAA.202609_58(9).06

[Ismail, Izham Izzat](#); [Mahat, Yusuf](#); [Razak, Firdaus Abdul](#); [Azami, Muhammad Hanafi](#)

Department of Mechanical and Aerospace Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53100, Malaysia

[Show all information](#)

0

Citations

[Full text](#) [Export](#) [Save to list](#)

[Document](#)[Impact](#)[Cited by \(0\)](#)[References \(22\)](#)[Similar documents](#)

Abstract

The low regression rate of conventional hybrid rocket motors (HRM) remains a significant challenge. Paraffin wax has emerged as a promising hybrid rocket fuel due to its high regression rate. However, its weak mechanical properties limit its practical application. To address this, the study embeds a 3D-printed skeleton within the paraffin grain to serve as a secondary fuel and enhance the grain's mechanical properties. Various 3D-printed skeleton designs, including Tri-Hexagon, Hilbert curve, and Octagram spiral patterns, were fabricated from PLA and evaluated. The research focuses on assessing the mechanical and ballistic performance of these designs through compression tests and static firing tests. Key findings show that the Hilbert curve design demonstrated significant improvements, with a 50.48% increase in Young's modulus and a 20% increase in the regression rate

compared to pure paraffin. Overall, the armored grains showed enhancement in both mechanical and ballistic properties, with increases in Young's modulus ranging from 50.48% to 138.75% and regression rates from 11.43% to 20%. These results highlight the armored grain's potential as a robust solution for hybrid rocket applications, combining improved mechanical strength with superior combustion performance. © 2026, Journal of Aeronautics, Astronautics and Aviation. All rights reserved.

Author keywords

Armored Grain; Hybrid Rocket; PLA

Indexed keywords

Engineering controlled terms

Armor; Ballistics; Elastic moduli; Military applications; Regression analysis; Rocket engines; Rockets

Engineering uncontrolled terms

Armored grain; Hilbert curve; Hybrid rocket motors; Hybrid rockets; Mechanical; PLA; Property; Regression rate; Rocket fuels; Young modulus

Engineering main heading

Compression testing; Musculoskeletal system

Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
International Islamic University Malaysia See opportunities by IIUM ↗		IIUM

Funding text

The author(s) would like to express sincere gratitude to International Islamic University Malaysia (IIUM) for financial support through the Imtiaz Award Scholarship.

Corresponding
author

M.H. Azami

Affiliation Department of Mechanical and Aerospace Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53100, Malaysia

Email address hanafiazami@iium.edu.my

Abstract

Author keywords

Indexed keywords

Funding details

Corresponding authors

What is Scopus

Content coverage

Scopus blog

Scopus API

Privacy matters

[日本語版を表示する](#)

[查看简体中文版本](#)[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

<https://www.scopus.com/pages/publications/105050787140?origin=resultslist>