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**Technology**

**LUNAR HABITAT CONSTRUCTION USING REGOLITH-PEEK COMPOSITE  
BRICKS: DESIGN AND STRUCTURAL ANALYSIS FOR  
SUSTAINABLE MOON OUTPOSTS**

**Matteo Cafaro<sup>(1)</sup>, Carlo Ferro<sup>(1)</sup>**

<sup>(1)</sup>Politecnico di Torino, 10129, 0110906850, [matteo.cafaro@polito.it](mailto:matteo.cafaro@polito.it)

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**ABSTRACT**

This study presents the design and structural analysis of sustainable lunar habitats utilizing the recently developed regolith-PEEK composite bricks. Building on Torre et al.'s groundbreaking research (2025), which demonstrated that regolith composites with minimal thermoplastic binder content (5-10 wt%) exhibit mechanical properties suitable for construction applications, we propose modular habitat designs that leverage these innovative materials. Our structural models incorporate interlocking brick systems that eliminate the need for mortar and enable rapid assembly by autonomous systems. Through finite element analysis under lunar environmental conditions, we evaluate various architectural configurations including Nubian vault-inspired designs that provide self-supporting structures with optimal radiation shielding. The models demonstrate that habitats constructed with these composites can withstand thermal cycling (-178°C to +124°C), vacuum conditions, and reduced gravity while providing essential protection against micrometeorite impacts and cosmic radiation. This approach significantly reduces Earth-sourced material requirements, with only 5-10% of construction mass needing to be transported from Earth. The proposed designs represent a critical advancement in sustainable lunar infrastructure development, enabling long-term human presence through efficient in-situ resource utilization and addressing key challenges in establishing permanent lunar outposts.

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**Comments:**

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