



NIKKAN KOGYO SHIMBUN PRESS,

Interview with Claude Maack,

CEO of GRADEL:

Aug. 23<sup>rd</sup> 2024 by Tadashi FUJIMOTO

# 衛星構造体7割軽量化

ルクセンブルク・グラデル、積層技術開発



## AI×ロボ 繊維を樹脂で固化

ルクセンブルクのグラデル(Grade)は金属の構造部材に比べ最大約70%軽い超軽量化技術を開発した。来日したクロード・マーク最高経営責任者(CEO)によれば人工衛星をはじめ欧州の宇宙産業で先行して普及を進め、日本の航空宇宙・飛行ロボット(ドローン)、自動車、物流分野への参入も狙う。大学・研究機関と兵団で応用研究を進めたいという。(藤元正)

### 航空・車・物流展開も狙う

グラデルは1965年設立のエンジニアリング企業。原子力発電所の廃炉を含めた保守に関わる機器を製造し、09年には衛星の組

み立てに使われる地上層造形(GRAM)に「技術の開発に乗り出した。GRAMは人工知能(AI)でのトポロジー最適化を基盤とした3次元(3D)設計・シミュレーションと、6軸ロボットによる部材の配置および樹脂の塗布工程で構成。筒状のブッシュ部品の間には繊維素材を渡してブッシュが突端となる3D構造を作り、樹脂で固化することで軽量かつ強固な構造体を形成する。

炭素繊維(CF)をはじめ天然素材の亜麻や玄武岩のバサルト繊維など、さまざまな繊維が利用可能だ。マークCEOによれば、GRAMは欧州宇宙機関(ESA)と、欧州エアバス、フランスのタレス・アレーニア・スペース、ドイツのOHBシステムなど欧州の衛星企業がプロセスを認定済み。アンテナアフラケットでは71%、ロケットから衛星を放出するディスプレイ部では60%の軽量化を目指し開発中で、この機構を組み込んだ衛星が26年に打ち上げられる予定という。

さらに「航空機やバスの座席、輸送用パレットなどに適用すれば燃費改善と温暖化ガス排出削減につながる」と(マークCEO)。欧州域内の物流で標準的な木製の「ユーロパレット」は重量が20〜25kgもあるが、再生可能な発泡素材にGRAMの構造体を埋め込んだパレットは4・2kgと軽くて扱いやすい。ただし、GRAMではエポキシ樹脂を使い、材料のリサイクルが課題。そのためマークCEOは「現在新しい樹脂を開発中で、2〜3年後には樹脂と繊維を分離できるようなもの」と説明する。

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## **Luxembourg's Gradel Develops Layered Technology, Reducing Satellite Structures' Weight by 70% with AI and Robotics – Aiming for Aerospace, Automotive, and Logistics Sectors**

### **Head**

### **Article:**

Gradel, a company based in Luxembourg, has developed an ultra-lightweight technology (GRAM) that reduces the weight of structural components by up to 70% compared to metal alternatives. According to CEO Claude Maack, who recently visited Japan, this technology is expected to gain widespread adoption in Europe's space industry, particularly for satellites. The company also aims to enter the Japanese aerospace, drone, automotive, and logistics markets. Gradel is interested in advancing applied research through collaborations with universities and research institutions. (By Masashi Fujimoto)

### **Body:**

Gradel, an engineering company founded in 1965, has been manufacturing equipment related to the maintenance of nuclear power plants, including decommissioning. In 2009, it entered the space business by providing ground support equipment used in satellite assembly. Given the high demand for lightweight materials in this field, Gradel began developing the "Gradel Robotic Additive Manufacturing" (GRAM) technology in 2018.



GRAM is based on AI-driven topology optimization for 3D design and simulation, combined with a six-axis robotic system that handles material placement and resin application. The process creates a 3D structure where bush components are linked by fiber materials, with the bushes serving as end points. The structure is solidified with resin, resulting in a lightweight yet robust component. A wide range of fibers can be used, including carbon fibers, natural flax, basalt fibers, rayon, and glass.

According to CEO Maack, GRAM has been certified by the European Space Agency (ESA) and major European satellite companies like Airbus, Thales Alenia Space in France, and OHB System in Germany. They are currently developing components such as antenna brackets, targeting a 71% weight reduction, and dispenser parts that release satellites from rockets, aiming for a 60% weight reduction. The satellite equipped with this technology is scheduled for launch in 2026.

Furthermore, Maack mentioned that "applying this technology to airplane or bus seats, as well as transportation pallets, can improve fuel efficiency and reduce greenhouse gas emissions." The standard wooden "Euro pallets" used in logistics within Europe weigh 20-25 kilograms, but a pallet incorporating a GRAM structure with a renewable foam material weighs only 4.2 kilograms, making it lightweight and easier to handle.

However, GRAM currently uses epoxy resin, posing a challenge for material recycling. To address this, Maack explained that "we are currently developing a new resin, and in 2-3 years, we aim to make it possible to separate the resin from the fibers."

**AUG 23<sup>rd</sup> NIKKAN KOGYO SHIMBUN**

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