Laser Sintering: Igniting Innovation Across Sensing, Automotive, and Space

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Our primary objective is to share the endeavors undertaken within the laser-matter interaction community concerning the application of laser sintering as an additive manufacturing tool. The potential of this technique has been thoroughly explored across various domains such as Food Industry, Energy sector, Automotive packaging, and Space exploration.

Direct laser sintering facilitates the mass production of digital conductive and dielectric patterns. This innovative approach offers substantial benefits to existing additive manufacturing technologies, resulting in products characterized by reduced resistivities, enhanced adhesion, high aspect ratios, and high-resolution line patterns on flexible and temperature-sensitive substrates. The development of transformative, cost-effective technologies has been a central focus, aiming higher aspect ratios and finer patterning, in alignment with the prevailing trend towards sustainability and environmental stewardship.

Illustrative examples of laser sintering applications within the energy sector, such as the fabrication of photovoltaic grid electrodes, will be presented. Additionally, insights will be provided into the utilization of this additive manufacturing method, alongside adaptive laser ablation and drilling, in the production of advanced compact automotive sensor packages for autonomous vehicles. Our efforts have been dedicated to the meticulous design and optimization of fabrication processes, achieving impressive speeds of up to thousands mm/sec, with the objective of seamless integration into a pilot line.

The Food industry, encompassing crucial activities such as resourcing, production, processing, packaging, and marketing of edible goods, represents a cornerstone of the global economy. As global initiatives towards ensuring food safety and security gain momentum, there is a heightened interest in smart, "active" food packaging technologies. A notable highlight of our presentation will be the development of intelligent food packaging CO_2 sensors capable of monitoring gas released during food shelf life, achieved through precise localized laser sintering techniques.

Furthermore, international endeavors are focused on in-situ resource utilization (ISRU), aimed at minimizing costs associated with lunar and Martian missions. The utilization of indigenous space materials for fabricating objects, components, building blocks, or platforms utilizing additive manufacturing techniques assumes paramount significance. Preliminary findings in the laser sintering of regolith will be discussed in this context.