Exposure of an inlet guide vane (IGV) in the LPBF process.

Ecologically sustainable aviation through additive manufacturing

In the mobility sector, commercial aviation contributes significantly to greenhouse gas emissions. Since there are few alternatives to this form of transportation, especially on long and intercontinental routes, industry and research are focusing their efforts on making air transport more sustainable. The development and spread of new technologies such as Additive Manufacturing (AM) can make a decisive contribution to this: These processes are characterized by high resource efficiency combined with high weight savings through topology optimization.

In this context, the Laser Powder Bed Fusion department at Fraunhofer ILT is participating in the EU research program "Clean Sky 2," which aims to significantly reduce the ecological impact of aviation on our habitat.

Development of models for the ecological assessment of additive manufacturing

Life Cycle Assessment is used to evaluate the ecological impact of AM processes. Fraunhofer ILT used ecological analyses to initially record the material and energy flows required in component production for the necessary sub-processes, e.g. the laser powder bed fusion process. Together with partners, Fraunhofer ILT recorded primary data for the Life Cycle Inventory (LCI) at machine level during production. This data was then used to create models of the process chains, from the raw material production to the recycling of the component. Using the models developed, the project partners were able to identify and substitute relevant emitters with sustainable alternatives.

Assessment of the ecological footprint for additively manufactured aerospace components

Fraunhofer ILT set up and evaluated the ecological analyses for several applications and materials. Thanks to AM's high degree of freedom in production, high recycling rate of the powder material and weight savings, the institute's analyses show that additive manufacturing has a smaller ecological footprint than conventional production routes, despite the high energy consumption during production. Particularly in repair applications, additive manufacturing processes constitute an ecologically sustainable alternative to conventional processes.

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