



## TOPOLOGY-OPTIMIZED WHEEL KNUCKLE WITH INTERNAL GRADED LATTICE STRUCTURES

### Task

In the face of climate change, reducing fuel consumption and reducing emissions in the automotive sector are imperative. Weight-reduced lightweight components, for example, have great potential for saving natural resources. With the help of Selective Laser Melting (SLM), also known as laser beam melting or Laser Powder Bed Fusion (LPBF), it is now possible to build such lightweight components by exploiting the increased design freedom this process provides. In the context of the research project »ToPoLight«, Fraunhofer ILT developed, manufactured and successfully tested a load-adapted wheel knuckle made of the tempered steel 1.7734 with reduced volume for a prototype racing vehicle.

### Method

For the manufacture of the wheel knuckle, the institute has continued to refine the entire process chain, starting with powder development through design adaptation and SLM process development to final processing. Fraunhofer ILT has engineered both a process control for the processing of 1.7734 as well as process-specific design guidelines and manufactured the wheel knuckles.

### Results

Thanks to the load-adapted design, the volume of the wheel knuckle could be reduced by about 25 percent compared to the original. By adapting the outer structure and integrating load-adapted graded lattice structures, ILT was also able to increase the rigidity. In addition to installation in the prototype race car, the wheel knuckle has already been successfully tested on the test bench.

### Applications

The developed manufacturing chain for structural lightweight construction through topology optimization and the use of load-adapted graded lattice structures can also be adapted to automobile prototype construction and can thus contribute to a reduction in development times.

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### Contact

Tobias Schmithüsen M.Eng.  
Telephone +49 241 8906-568  
tobias.schmithuesen@ilt.fraunhofer.de

Dr. Sebastian Bremen  
Telephone +49 241 8906-537  
sebastian.bremen@ilt.fraunhofer.de

- 3 Wheel knuckle (cut open)  
with internally graded grid structure.  
4 Detailed view of lattice structure.