

INFLUENCE OF ECOLOGICALLY OPTIMIZED MANUFACTURING ON THE PRODUCTION COSTS OF C/C STRUCTURES USING CVI TECHNOLOGY

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Much development work in the field of ceramic matrix composites (CMC) in recent decades has focused mainly on improving mechanical, chemical and thermal properties and on optimizing cost-effective production processes. Within the framework of Composites United e. V. and its industrial members, various joint research projects are now starting which also deal with ecological, economic and circular economy aspects of CMC. These aspects have hardly been investigated so far but are attracting growing interest in politics and industry due to the increasing awareness of environmental impacts. The project team of the CU EcoCeramic collaborative research project is now focusing on these issues using carbon fiber reinforced carbon (C/C) as an example to show what the environmental footprint of C/C manufacturing looks like through the chemical vapor infiltration (CVI) route. On the one hand, the key performance indicators (KPIs) are considered. On the other hand, realistic future scenarios are calculated, such as the use of regenerative process energy or the further development of manufacturing technology. In addition to "green" carbon fibers and the use of regenerative gases, site-dependent factors and technological advancements to reduce infiltration time are also analysed. This is followed by an ecological and economic evaluation of exemplary, generic carbon/carbon CVI structures. The core of the work is the link between economy and ecology and the answer to the research question:

How do production costs change with ecologically more efficient component production?

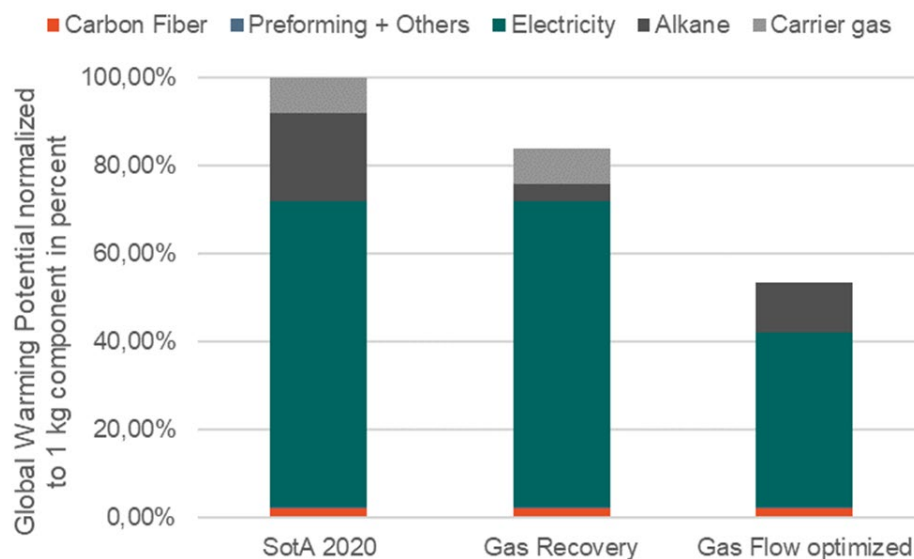


Figure 1: Global Warming Potential (GWP) of a generic, medium-complexity, medium-size, shell-like C/C structure fabricated using CVI (left – State of the Art 2020) compared to individual technological optimization steps.