Working Group
Additive Manufacturing

Perspective on Additive Manufacturing

Additive manufacturing (AM) - commonly referred to as "3D printing" - is a key technology for numerous high-end industries[1]. Its use makes processes more resource-efficient and sustainable, shortens product development cycles, facilitates assembly and maintenance, and shortens delivery times and routes. All of this increases productivity in production and secures production locations.

The prerequisite for maintaining technological leadership in this discipline is a value-added network of industry comprising mechanical engineering, materials production, process and manufacturing know-how, software and automation as well as research institutions.

The opportunities are enormous. The task now is to leverage this potential and drive it forward in the long term with the most innovative solutions.

Importance of AM for industry

1.) AM is a driver of innovation
2.) AM is Industry 4.0
3.) AM is sustainability
4.) AM means leadership

Demands for successful AM development

1.) Securing trade with AM machines and products internationally
2.) Keep AM in mind as a path towards the solution to social challenges
3.) Expanding the range of applications

[1] Aerospace, medical technology, semiconductor production, energy technology, drive technology, mechanical engineering, tool and mould making or consumer products

Mechanical Engineering Industry Association
Working Group additive manufacturing
Chairman:
Christoph Hauck

Lyoner Strasse 18
60528 Frankfurt am Main, Germany
Phone +49 69 66031453
Email: am@vdma.org
Internet: www.vdma.org

AM - Definition

AM refers to a wide range of different processes for the layer-by-layer construction of components made of metal, plastics, ceramics and numerous other materials. Laser beam, electron beam and UV systems are used for the process, but thermal and adhesive-based technologies and many others are also employed. The additive manufacturing process is preceded by fascinating design possibilities and is often intelligently networked with other processing steps.

Opportunities through AM

Compared to traditional methods, AM requires a different approach and offers new possibilities in the design and manufacture of products. Classic manufacturing methods often restrict the design freedom. By using AMproducts with , for example, improved properties in terms of stability and weight can be manufactured. Functional integrations reduce the assembly effort and often increase performance characteristics. The technical potentials and the associated potential for achieving political meta-goals are manifold (see table).

resources			competition		location	
functional integration	**less material**	**light weight / bionic**	**prototyping / single part**	**individua-lisation**	**repair**	**spare parts**
reduced assembly	efficiency	energy saving	time-to-market	personalisation, protection	reduced cost	print-on-demand
higher performance	reduced tool costs	high speed processes	logistics	adaption, ergonomic	short maintenance time	on-site

Table: Added value through additive manufacturing.

A. Why is AM important for industry?

1.) AM is a driver of innovation

- Functional integration in components (e.g. cooling) or lightweight construction leads to increased efficiency. This is an important contribution to achieving **climate neutrality**.
- Improving functions, e.g. increasing performance and reducing weight, enables **innovations** in numerous industries such as mobility.
- Acceleration of innovation cycles and transformation processes in companies increases the **speed of innovation.**
- **New and innovative materials,** e.g. for tool and medical technology, are processed.

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2.) AM is Industry 4.0

- AM only works with **digitalzation** of process and value chains. Without software chains and digitilization, products cannot be designed and machines cannot be run.
- The intelligently networked process chain improves **economic efficiency**, e.g. by shortening throughput times.
- New business models such as **on-demand** spare parts production are emerging.
- Industrial and medium-term economical production of **individual parts** is made possible (e.g. monolithic design or casting moulds) and contributes to the preservation of **manufacturing locations.**

3.) AM is sustainability

- AM ensures the careful use of important **resources** through local production when needed and achieves **material savings** by building only necessary structures.
- **Component weight** is reduced and thus **CO2 emissions** are saved, e.g. in aviation.
- Optimization of processes through **better geometries** saves energy, e.g. in flow or cooling optimization in industrial plants.
- **Repair** of components saves material usage, costs and energy.

4.) AM means leadership

- The AM technology is successful in a community of many manufacturers of machines, materials, periphery and software, but also users.
- **Jobs** along the entire additive value chain are secured and new ones created.
- World-leading **expertise** through institutes, universities or research institutes means innovation by AM.
- **International competition** is both a challenge and an opportunity - a fair network of experts secures the future of technology

B. Securing, strengthening and expanding AM locations

1.) Securing trade with AM machines and products internationally

- **Free trade relations** are necessary for the economic success of the new technology on the world market. The export of AM technology is in danger of being restricted by protectionist measures; here, a sense of proportion should be applied in consultation with industry (export control).
- Permanent subsidies in single markets lead to distortions of competition - we therefore need a political debate on the situation without prohibitions on thinking in order to ensure **international equality of opportunity** and a level playing field; but we do not want a subsidy race.

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2.) Keep AM in mind as a path towards the solution to social challenges

- AM is a key technology and the **core knowledge** needs to be strengthened.
- To reduce investment hurdles and to speed up technology implementation, there is a need for a **political commitment to AM**. AM technology dialogue between politics and industry has to take place.
- Intensive **coordination of activities** in the field of AM as a future new cross-sectional technology is necessary between all clusters, states, and ministries.
- Educational institutions should be financially supported in the **acquisition of AM systems**.

3.) Expanding the range of applications

- The enabler properties of the technology mean an indispensable added value in many application areas such as mechanical engineering and must be part of the **engineer's toolbox.**
- AM skills through **improved education** in schools, universities and companies are needed.
- **Knowledge transfer** from research institutions to industry needs to be improved.
- In order to further develop the technology with a focus on industrial suitability and increased productivity in the sense of a "smart factory", an **application initiative** must be launched, especially for industrial SMEs.
- **Cross-disciplinary consortia** consisting of material, machine, software, automation, and production have to be expanded for the development of large mega-applications (e.g. electromobility, hydrogen technology, individualization).

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