RESEARCH PROJECT

Products optimisation with New Additive Manufacturing Powders

Additive Manufacturing processes are able to produce parts with complex shapes and, therefore, allow the design of new products with enhanced properties (light weight, reduction of the assembly operations, optimum materials distribution according to the necessary parts properties, new design abilities). However, the quality of the final product, and even of the final material, is strongly dependent on the process conditions and on the composition of the basic raw material. The materials in use are still very restricted today due to the process related constraints in combination with specific materials properties which aggravate their processing to valuable parts.

In the foreseen project **Products optimisation with New Additive Manufacturing Powders** (PONAMP) the focus will be on the powder bed based additive manufacturing of metallic parts, i.e. on parts manufactured by the LBM and EBM processes.

In a previous project (OpP3D), the partners of the present consortium were dealing with the optimisation of standard powders, predominantly by trying to improve their processability through surface coatings on the relevant powders. The results were very promising and did show that the controlled application of metallic and non-metallic layers on the powder particle surfaces is realizable and leads to an improvement of the powder properties in view of being processed by LBM and for enhanced part properties. The successor project PONAMP sets up on these results by using and further improving the developed coating techniques and by investigating new materials combinations for AM products with enhanced properties. Two materials classes will be in the focus of the project: Cu and Cu base alloys and Al alloys.

On the side of coated pure copper/copper alloy powders, the main focus is on the processing by LBM for enhanced products by increasing their temperature resistance and mechanical properties while simultaneously retaining their outstanding functional properties, i.e. the very good electrical and high thermal conductivities. For special applications and for a performance and cost comparison, AM parts will also be investigated by using EBM as parts manufacturing route. Applications are seen here predominantly in the electrical / electronics industry where low-weight and design-optimized functional parts have to bear heavy loads (electrical, thermal, and mechanical).

On the side of aluminium alloys, coatings will be developed and applied in order to overcome short-comings

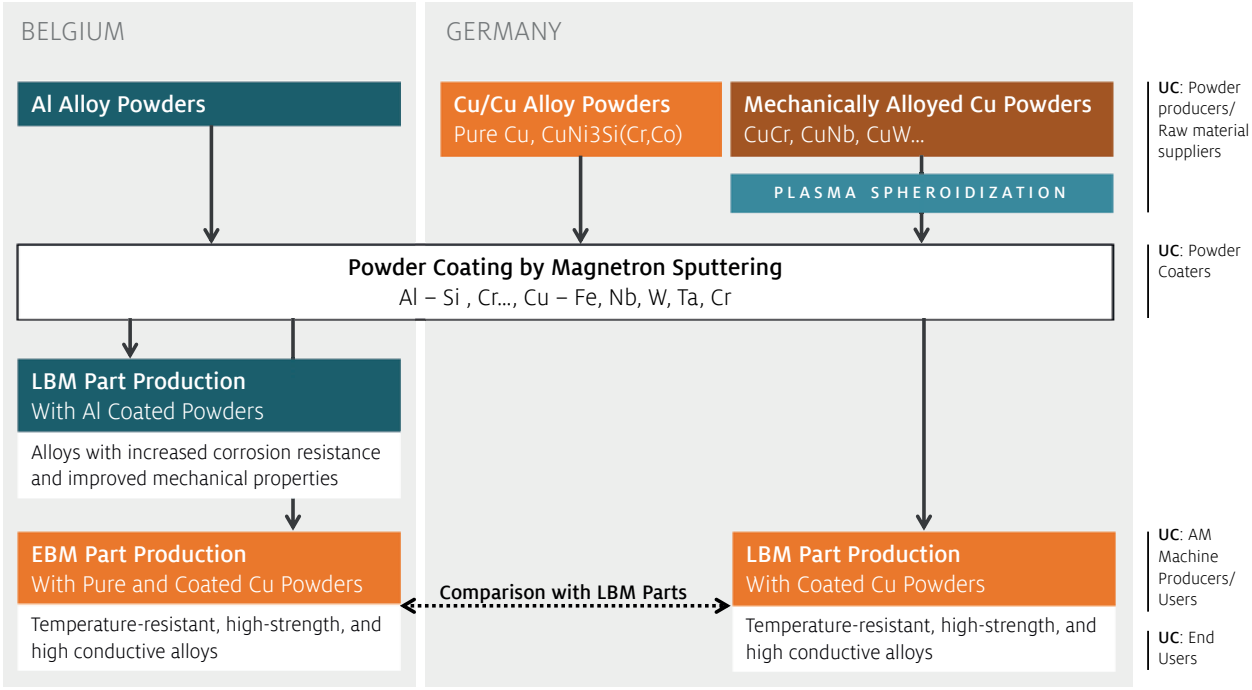

Fig. 1 | Work flow, the distribution of tasks and the links between the partners' activities

in the parts manufacturing with LBM methods which hinder the AM technique to produce parts from high performance Al base alloys. The coating with controlled levels of e. g. Si, Cr and other additives will be developed to enable the final material/part to reach mechanical properties comparable to one made by "conventional" production routes, i. e. from the Al 6xxx and 7xxx alloy family. The coating of the powders will also aim to improve the oxidation resistance of the powders itself and, therefore, will enable a higher re-use rate and durability of the powder. For the two types of application cases, a cost estimation will also be performed in order to assess the economic viability of AM techniques compared to conventional manufacturing techniques.

The partnership composition and the distribution of the tasks between partners will be similar to what they were in the OpP3D project:

- Fraunhofer UMSICHT institute will be responsible for the preparation and surface treatment of specific powders
- Materia Nova will be in charge of the functionalisation coating, plasma treatment of the powders
- fem and SIRRIS will take care of the production and testing of samples: fem will produce parts in Cu alloys by LBM, SIRRIS will produce the aluminium parts by LBM and also parts in pure copper by EBM, to compare their properties with the copper parts produced by fem

This project shall be proposed as a CORNET project, and needs the support of SMEs in the 2 countries involved in the project. This "users group" plays an advisory role in terms of project orientation and implementation strategy. The SMEs will be representatives of the value chain, i.e. in the fields of powder production / plant construction, AM-machine provision, component fabrication and end-use. They will provide the test cases and give advice and feedback to enable the fast transfer of results into the industry. They will attend the users group meetings and take care that the evolution and the results of the project are reaching their needs and expectations.

The diagram in Figure 1 intends to clearly describe the work flow, the distribution of tasks and the links between the partners' activities. The different tasks are related to the actors of the production chain (on the right) who will be involved in the project as members of the Users Committee (UC).

Acknowledgment

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Industry Partners

Arnd Sauter GmbH | BMW AG | ECKA Granules Germany GmbH | INDUTHERM Erwärmungsanlagen GmbH
KME Germany GmbH & Co.KG | Reischauer GmbH | SCHMELZMETALL Deutschland GmbH | Trovus Tech GmbH
Unicorn Engineering GmbH | Höganäs/H.C. Starck Surface Technology and Ceramic Powders GmbH | SAGITA SA
Diarotech SA | Ionics SA | Nemotherm SPRL | FN Herstal SA | EREM SA | Image Matters SA | ThalesAlenia Space SA
Manetco SPRL | AMOS SA | SONACA SA | Höganäs Belgium SA | Thermallium SPRL | Euro Heat Pipes SA
Innovative Coating Solutions SA

Research Partners

Fraunhofer UMSICHT, Sulzbach-Rosenberg/Germany | MateriaNova, Mons/Belgium | sirris, Brussels/Belgium

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