

Switzerland

3rd Annual SVMT Expert Group Powder Technology Meeting

After one year break, the 3rd Annual SVMT Expert Group Powder Technology Meeting was a hybrid event organised by the experts Dr Frank Clemens, Empa Dübendorf/CH; Prof. Bruno Bürgisser, HES-SO Friborg/CH and Prof. Efrain Carreño-Morelli, HES-SO, Sion/CH. Due to the pandemic situation, the meeting was organised under the 2G-rules – vaccinated or recovered. In addition, it was possible to attend the meeting online.



Fig. 1 Participants of the 3rd Annual SVMT Expert Group Powder Technology Meeting

Because of the 20 year anniversary of Additive Manufacturing (AM) activities at HES-SO Valais-Wallis, the meeting took place under the motto “Powder Technology-Based AM Methods” and the idea was to give an overview on selected AM-methods for polymer, metal and ceramic materials. More than 40 participants from industry and research labs with a focus on powder metallurgy, ceramics and inorganic fillers were present at the hybrid meeting.

After the opening by Prof. Efrain Carreño-Morelli, the meeting started with a short presentation of the SVMT (Swiss Association for Materials and Technology) and HES-SO Valais-Wallis School by Dr Frank Clemens and Prof. Efrain Carreño-Morelli, respectively. Dr Frank Clemens informed about the new Anwenderkreis Additive Keramische Fertigung that will be setup in the DKG – German Ceramic Society. and Prof. Efrain Carreño-Morelli showed an overview of the 20 years in AM on metals and metal-ceramic composites in Sion. Afterward, seven lectures from aca-

demia and industry on AM, which was followed by enriching discussions with the participants.

Prof. Gioele Balestra from iPrint HEIA-FR, Fribourg/CH, presented **Challenges and Opportunities of Binder Jetting from an Inkjet Perspective**. He showed that this technology can be used for powder, metal and ceramic materials. He explained the rheological characterisation of the inks using high-frequency analysis and the Tri-Master filament stretching method for the development of better inks. iPrint uses print heads with a self-circulation ink system. The advantages and limitations of this printing technology were discussed. Finally, he presented the results of some selected projects and the iPrinting Center in Fribourg.

Prof. E. Carreño-Morelli presented his work on **Recent Advances on Solvent on Granules 3D-Printing**, a technique invented in his lab to process steels, low thermal expansion alloys, titanium, and more recently cemented carbide parts. He demonstrated the fabrication of drilling tool bits made of WC with 12 % Co binder, which were de-

veloped in an Innosuisse project with Hilti AG. He explained how HIP post-processing allowed to achieve good results in percussion drilling of concrete. Further research is still necessary to meet the standards for application in the construction sector.

Afterward, David Burnand from Instrumat SA, Renens/CH, gave a presentation on **Challenge to Disperse and Measure Fine Powder in the Micro-Nano Range Using Dynamic and Static Light Scattering Techniques**. He started with an overview of analytic machines to characterise particle size, shape, stability and molecular properties. In his presentation, he explained how electrostatic, steric and combination of both will affect the quality of the particle size of dispersions. Finally, he demonstrated how to use zeta potential and the right pH to evaluate the particle size without agglomerates.

The afternoon session started with a talk by Somashree Mondal from Empa, Dübendorf/CH, on **Pellet Printing of Soft Thermoplastic Elastomers – New Soft Robotic Sensor/Actuator Modules Using Functional Inorganic Filler Materials**. She started with an overview of different extrusion heads for material extrusion AM technique, also known as FFF printing. Using pellet-based extruder it is possible to print soft elastomer materials with integrated sensors based on inorganic materials, like carbon and magnetic particles using multi-material printing approach.

Michael Wagner, from ETHZ, Zürich/CH, presented his activities in the field of filament printing of metals: **Fused Filament Fabrication of Stainless-Steel Structures – from Binder Development to**



Fig. 2 Somashree Mondal from Empa during her presentation (Figs.: Empa)

Sintered Properties. In his presentation, he explained how he optimized the binder composition and powder content of a feedstock to achieve dense 316L sintered structures. He proposed the use of an elastic polymer like TPE to achieve the flexibility, needed for the metal filament printing process. The sintered parts exhibit good shape

preservation and were tested under compression tests.

Later, Fabian Hubschmid, Fabru GmbH, Epnat-Kappel/CH and Dr Frank Clemens, presented the development of ceramic filaments under the title **Swiss Ceramic Filaments: Transfer of Filament Development to Production.** A small overview of the Fabru GmbH startup was given. Then, challenges in filament printing of ceramics and the different processing steps to develop the ceramic filaments were discussed. After showing the production scale-up, case studies for potential applications were presented.

Before starting the lab tour, Torsten Remmler from Netzsch GmbH, Selb/DE presented the **Characterisation of Compounding Behavior of Ceramic Feedstocks Using Capillary Rheometer.** In this presentation, he showed a study in collaboration with DDP Specialty Products Germany GmbH &

Co. KG. In this case study, a rheometer was used to investigate the homogeneity of ceramic feedstocks using two different methylcellulose binders and varying the mixing time. Interestingly the mixing time evolution clearly probes the activation of the cellulose binder. However, a correlation between homogeneity (deviation of the pressure value) and mixing time could not be observed.

The meeting concluded with a lab tour, where the participants could visit the new building of the Powder Technology and Advanced Materials Group. The different labs are dedicated to powder characterisation, mixing and shaping, including uniaxial cold pressing, injection moulding, hot isostatic pressing, AM by binder jetting, SLM, and mechanical testing, as well as sintering furnaces for metals and oxide ceramics.

The next Expert Meeting is planned for the end of November 2022 in Lugano at SUPSI. An exact date will be announced.

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