INDUSTRIAL PILOT PROJECT

High energy X-ray imaging for operandum probing of the jetting deposition of suspensions for electronics production

THE INDUSTRIAL CHALLENGE

Advanced electronics are a prerequisite for modern society, regardless of whether it concerns how we communicate, work, or are entertained. Electronics are becoming more and more compact and require increasingly accurate manufacturing methods, where the placement (deposition) of small volumes of electrically conductive material is needed to produce functional mounted circuit boards. The ability to see the actual deposition process will benefit our understanding of how we can affect the process to enable the electronic products of the future. However, it is a huge challenge to visualize a process where a suspension of metallic balls the size of a red blood cell is forced through a nozzle made of stainless steel and ejected at a speed of tens of meters per second.

WHY USING A LARGE SCALE FACILITY

To probe this jetting process in operation, i.e. in the nozzle of the actual jetting head used in the industrial product, requires an extremely bright x-ray source together with a very fast camera in order to be able to detect motion of the fluid with sufficient resolution.

HOW THE WORK WAS DONE

The experiments were performed at the ID19 beamline of the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, which provides the world's brightest synchrotron light source for hard X-rays. The extremely fast imaging camera of ID19 is able of taking up to 2,1 million images per second with a resolution down to ca 1 µm. A mobile operandum testing unit that allowed for optical access to the jetting head in the experimental bay was built specifically for the trials. The head of technical support for ID19 at ESRF, Alexander Rack, was instrumental for the successful imaging experiments. One day was required for experimental setup and testing, and one for beam adjustment and the actual imaging trials.

THE RESULTS AND EXPECTED IMPACT

The high-speed X-ray images of the jetting process offered the first detailed opportunity to look into the millimeter-sized steel structure and simultaneously testing our theories of how the liquid moves. Advanced image processing made it possible to follow the fluid's movement during the ultra-fast sequence of events, and to compare this information with a digital twin that also was created. With that knowledge, we will be able to develop new methods to control the volume and quality of deposited material. In turn, this will allow the efficient, digital production of the electronics of the future.

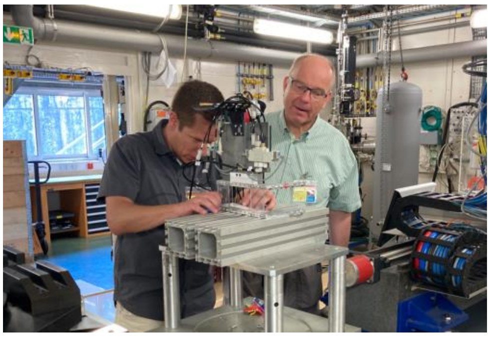

Figure 1 :. Daniel Brevemark and Jesper Sallander from Mycronic checking the jetting setup at ESRF.

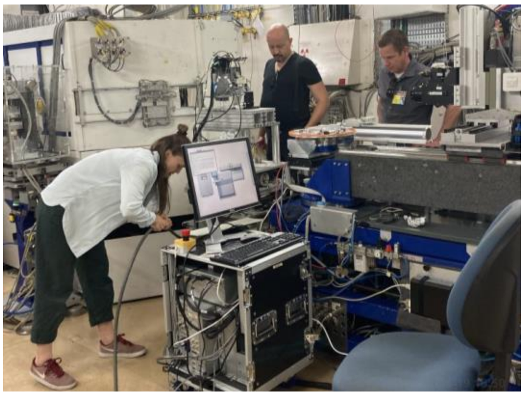

Figure 2 :.Adjusting the setup with ESRFs technical staff in the experiment hutch.

"To finally be able to see the jetting process, something we have speculated about for years, was fantastic!" /Gustaf Mårtensson, Mycronic

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