Technology Offer

IceJet: ice abrasive water jet cutting technology for a reduced environmental footprint

Potential use cases and/or markets (applications):
Production technologies, Food industry, Sealing technologies, Hard-Alloys-Machining

Current state of technology:
Prototype – TRL 6

Intellectual property:
Pending

Developed by:
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Reference:
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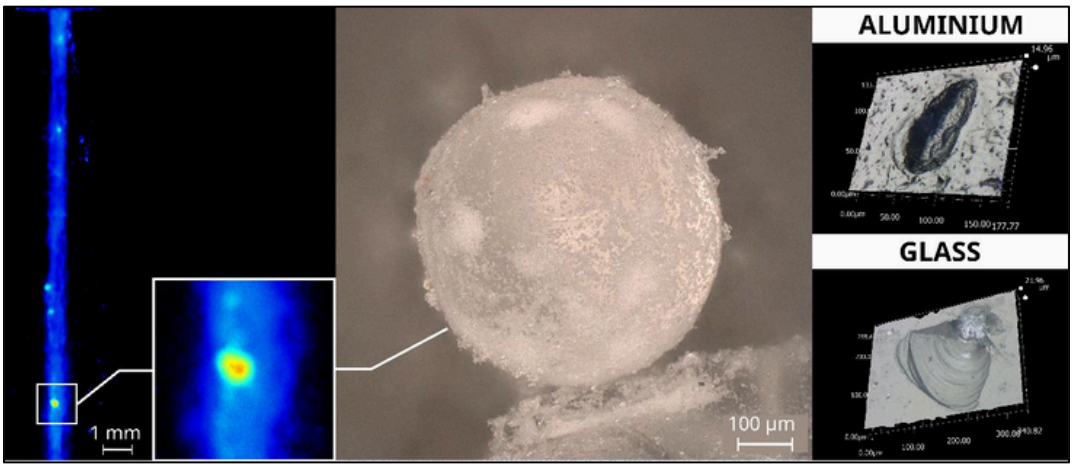

Background

Abrasive ice water jet (IAWJ) technology is a pioneering development within AWJ cutting technologies. The existing AWJ cutting machines use mineral particles at a standard ambient temperature. These mineral abrasives can reach high velocities in the form of a water jet (over 600 m/s depending on the working pressure). The use of ice instead of abrasives is possible at very low temperatures of the ice particles (below -100°C), given that only at these temperatures does the ice have the mechanical properties required for effective material removal.

Description of invention

The innovation comprises a solution for producing ice particles and a system to effectively incorporate them into a high-speed water jet for cutting applications. 1. This system enables the production of ice particles with certain sizes, forms, and crystalline structures. These are ideal for removing materials such as metals, polymers and biomaterials that are difficult to process with a standard water jet alone. 2. It enables the efficient management, transfer, and introduction of these ice particles into the cutting head at temperatures around -190°C. 3. In addition, the solution enables precise control of various parameters within the cutting head, including the temperature of the high-speed water jet (down to -20°C), the stability of the mass flow rate and the temperatures of the conveying gas and the walls of the cutting head. Strict controls are implemented across all aspects of the system to maintain the temperatures of the ice particles at an optimum level, which is crucial for their effective material removal and transportation properties.

The technology is intended for use in areas including food industry, healthcare, sealant manufacture and the machining of heavy materials such as titanium alloys, which are currently processed using abrasive water jet cutting, although the inclusions are undesirable.

Main advantages

The primary advantages of using ice instead of mineral abrasives is the cleanliness of the machining process while maintaining a high cutting performance. Cooled ice particles outperform the soluble abrasives, as ice has a higher hardness and compressive strength at low temperatures. Post machining, the ice particles melt, and the workpiece remains clean and free of inclusions. The temperatures at the cutting edge are lower, which is important for applications in the food industry and in microtechnology. From an environmental point of view, the amount of particles in waste w ater is 99 lower compared to AWJ.