Big Science Business Forum 2024

TRIESTE
1 – 4 OCTOBER 2024

Host Organizers

REGIONE AUTONOMA FRIULI VENEZIA GIULIA · ILO Network Italia · AREA Science Park · IO SONO FRIULI VENEZIA GIULIA

Technology Transfer Track Posters

Efficient tungsten 3D printing

An inherent benefit of Electron beam powder bed fusion (E-PBF) is that it allows for precise and extremely fast beam positioning. In combination with high power, highly complex tungsten components can be produced efficiently and with tailored material properties.

Tungsten has unique material properties, but it is unfortunately a difficult material for conventional manufacturing. Electron beam powder bed fusion (E-PBF) opens new possibilities to efficiently produce complex parts in tungsten with superior chemical purity and density.

The electron beam can be moved up to 4 km/s. This opens for spot melting where the beam creates submillimeter melt pools that solidify individually. The time to create one melt pool is in the millisecond range, and beam jumping between melt pools is virtually instantaneous. This is beneficial for tungsten because it can evenly distribute the heat, reducing residual stress.

Even more interesting is that different spot melting algorithms will produce different microstructures, opening for microstructure tailoring.

The powder bed temperature is kept above 1200°C to reduce residual stresses. The heating is done with the diode electron gun which has an excellent beam quality through its full power range up to 6kW. This translates to higher productivity in both the heating and melting phase.

E-PBF is run at vacuum levels as low as 10^{-5} mbar. This does not only prevent oxygen pickup, but it actually purifies the tungsten from oxygen as the material is fused.

Freemelt uses a robust backscatter electron detector for in situ monitoring, according to the same principle as in scanning electron microscopes. This is particularly useful for tungsten which is notoriously difficult to examine with non-destructive testing methods.

freemelt

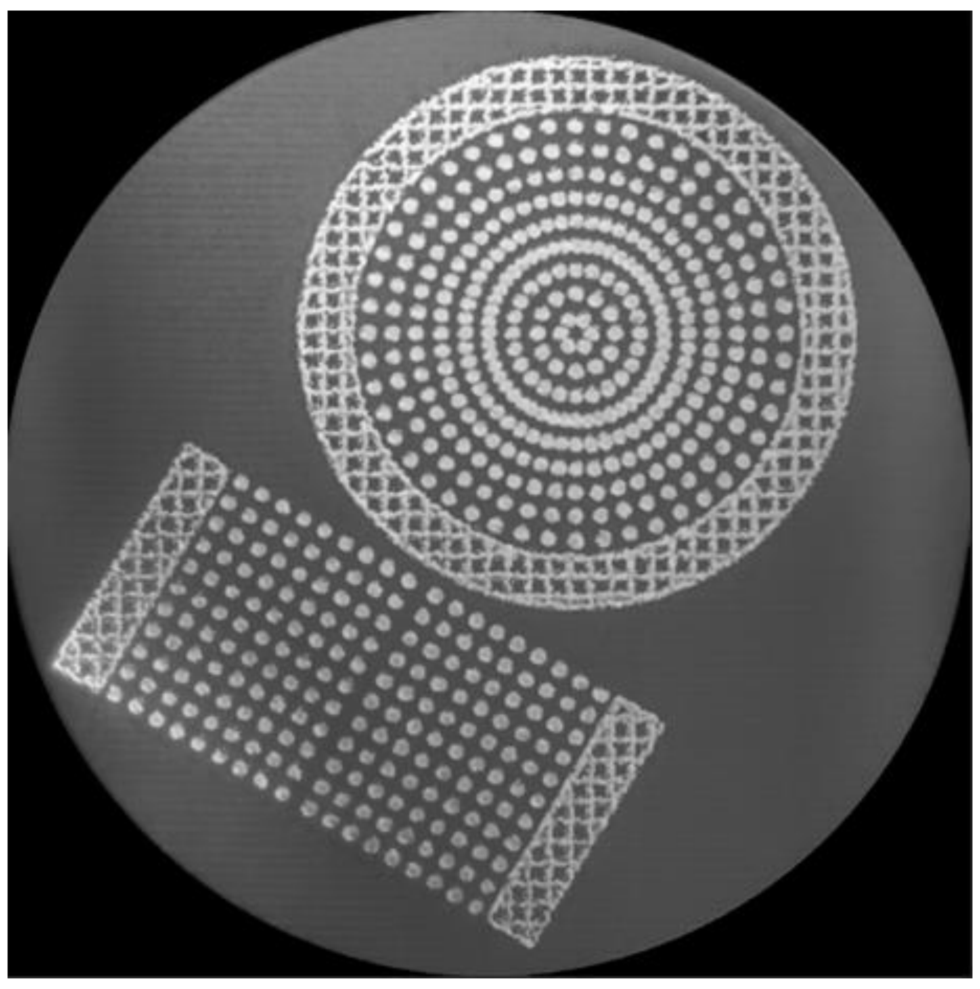

Image 1. In situ image of fusion reactor components during printing

Image 2. Stacked tungsten tiles for fusion energy research

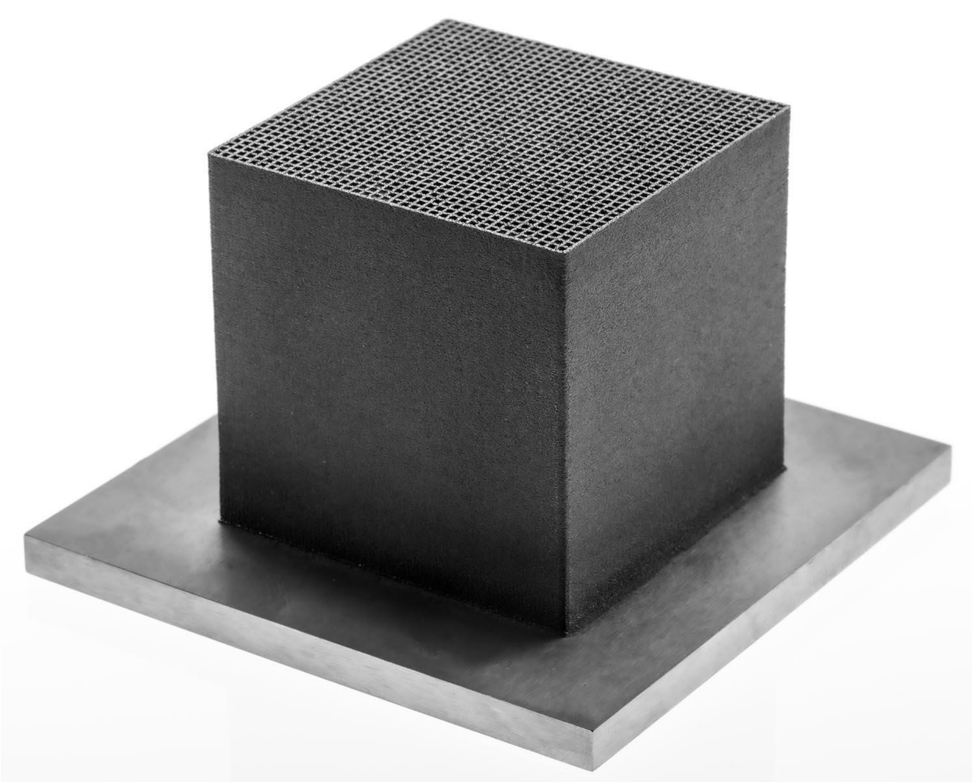

Image 3. Collimator

Image 4. Fully dense tungsten cube

BOOTH 15-17/ HALL 27

Reference person
Mario Rossi

Per Woxenius
per.woxenius@freemelt.com
www.freemelt.com

Download BSBF2024 app for live chat

If you like this poster, download the BSBF2024 app to vote for it and live chat