



Freemelt in fusion

2025-08-26, Per Woxenius

Transform manufacturing - for good

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# We are Freemelt

Transforming manufacturing - for good

## What we do

Founded in 2017 by seven engineers with extensive industry experience

Advanced E-PBF 3D printers for metal components

Leading supplier in additive manufacturing (AM)



## Where we focus

In industries and research that demand complex and high-performance materials & components

Defense, Energy, MedTech

Tungsten, Titanium, Copper



## Why Freemelt

Our modular printers offering significantly higher efficiency compared to other machines on the market

> 30 sold machines



## Our customers

Academia enabling industrial adoption of AM

Industrial customers aiming to innovate and enhance production efficiency



Global orthopedic implant OEM #1

Global orthopedic implant OEM #2



## Our printers are optimized for refractories

### **Powerful, 6kw electron gun**

Fast processing, and high powder bed temperatures  $> 1200^{\circ}\text{C}$

### **Robust recoater and tanks**

Allows powder flexibility for reduced cost, improved supply resilience, and supplier flexibility

### **Ultra-high vacuum environment**

Reduced contamination, and oxygen reduction, extended powder life, no inert gas



### **Open source**

Gain full control of electron beam parameters, and create your own IP through fully open software

### **Pixelmelt® spotmelting**

Increased geometry freedom and tailored material properties

### **Build tank water cooling, without rope seals**

Enables increased productivity, and maintaining clean environment

### **Backscattered Electron (BSE) Detector**

For in-situ process monitoring

# Freemelt's E-PBF technology in brief

E-PBF, Electron Beam Powder Bed Fusion uses electrons to melt the material

## Benefits of Freemelt's E-PBF technology

- ❖ Hot process reduces residual stresses
- ❖ Vacuum ensures material purity
- ❖ Exceptional beam speed (up to 4km/s)
  - ❖ Ability to tailor material properties
  - ❖ High productivity

Higher quality, higher efficiency



# Orders for plasma facing components

Freemelt builds business by performing feasibility studies to build trust and knowledge. For UKAEA:

1. Study to show capability (low TRL)
2. Study to show productivity
3. Study to show robustness
4. Order for industrial system

Orders coupled to UKAEA to further advance the TRL level for PFC's:

- Oxford Sigma
- F4E. Freemelt won their first ever technology development program including:
  - Material integrity
  - Tungsten to CuCrZr joints

2023

## Freemelt receives fusion research order

13 FEB 2023

– Will develop new methods for 3D printing with tungsten for fusion power plants

Nasdaq First North-listed Freemelt – a high-tech commercial company whose groundbreaking solution creates new conditions for rapid growth in 3D printing – has received an order for a materials development project from the United Kingdom Atomic Energy Authority (UKAEA). The order means that Freemelt will develop manufacturing methods to print components with tungsten for use in future fusion energy power plants. The order value exceeds SEK 1 million.

2024

## Freemelt receives a new order from United Kingdom Atomic Energy Authority (UKAEA)

30 APR 2024

Freemelt has received a new order from UKAEA for a tungsten materials development project aiming to accelerate the development of fusion energy.

Freemelt and UKAEA (United Kingdom Atomic Energy Authority) have been collaborating since 2023 on the development of material processes for E-PBF (Electron Powder Bed Fusion) printing of tungsten components for use in fusion energy power plants. Following the successful results of the initial

2025 Q1 and Q2

## Freemelt receives order from UKAEA for proof-of-concept of production scalability of tungsten tiles for future fusion energy power plants

5 FEB 2025

Freemelt has received an order from UKAEA (United Kingdom Atomic Energy Authority) to conduct production scalability tests of 3D printed tungsten tiles for fusion energy power plants, strengthening Freemelt's position in the energy sector. The order value is approximately SEK 0.7 million with expected delivery during the first quarter of 2025.

## Freemelt receives an order from Oxford Sigma for tungsten trial components

13 FEB 2025

Freemelt has received a project order from Oxford Sigma to conduct geometry tests of additive manufactured tungsten for fusion power plants. This is another order in fusion and tungsten in a short period of time, which strengthens the company's position in the energy sector. The project is planned to be implemented in the first quarter of 2025.

## Freemelt delivers the industrial machine, eMELT to UKAEA

20 MAR 2025

Freemelt has received an order from UKAEA (United Kingdom Atomic Energy Authority) for the delivery of an eMELT machine, further strengthening the company's position in the energy sector. The order value is approximately SEK 8 million.

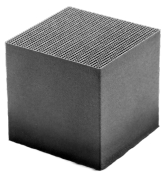
## Freemelt signs contract with Fusion for Energy to lead study in the field of tungsten tiles manufacturing

8 APR 2025

Freemelt has been entrusted to lead a feasibility study on behalf of Fusion for Energy (F4E), the EU organization responsible for Europe's contribution to ITER, together with other experiments in the field of fusion. The aim of the study is to qualify tungsten as material, and to conduct application tests for fusion energy applications. Its value is in the range of SEK 3 M and will run for 15 months, starting in the second quarter of 2025.

## Tungsten applications fit Freemelt's machines well

- ❖ High-temperature process enables the production of dense (>99.9 %) parts
- ❖ Vacuum environment minimizes oxygen uptake, preserving material integrity
- ❖ Powder flexibility allows various tungsten powder qualities, including cost-effective options



MedTech  
Radiation shielding

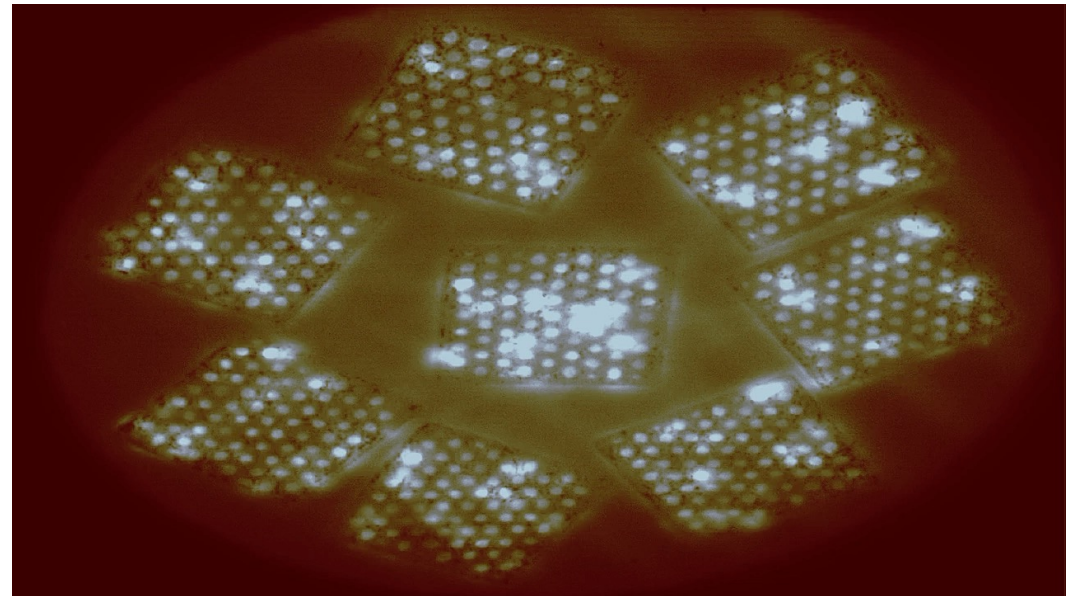


Energy  
Plasma-facing tiles for  
fusion reactors



Defense  
Nozzles

Tungsten plasma-facing tiles printed in e-MELT®



# Tungsten

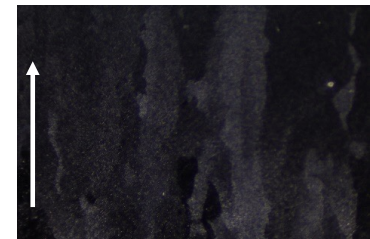
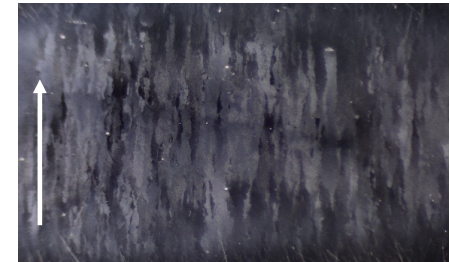
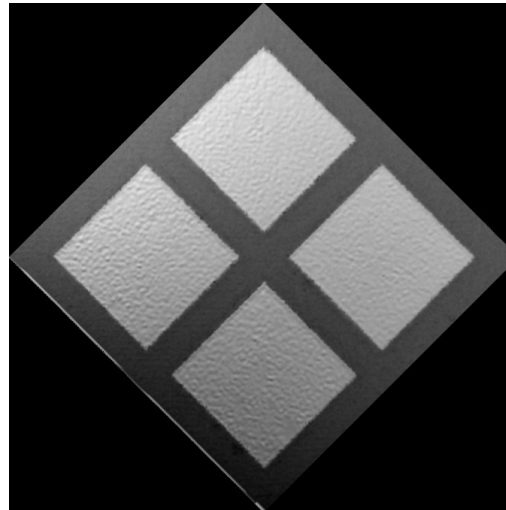
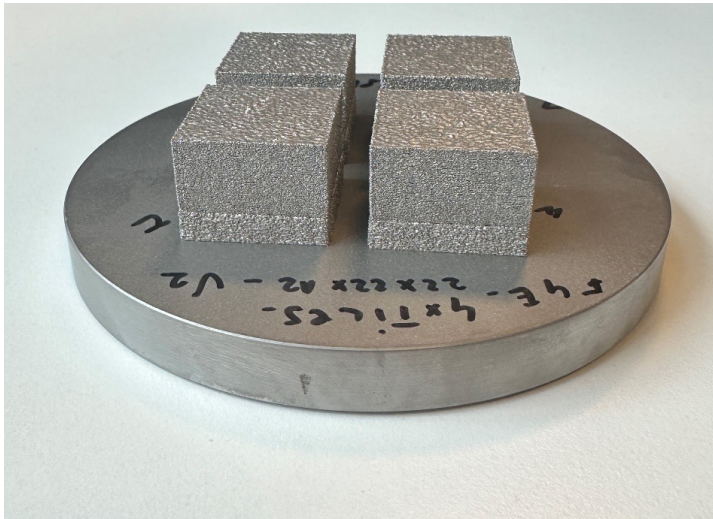
Bulk tungsten parts, contamination

Element	Powder	Line melting	Spot melting
Oxygen (ppm)	200 – 400	5-7	5
Carbon (ppm)	< 5	5	5
Nitrogen (ppm)	7-10	5	5
Hydrogen (ppm)	1	1	1



## Tungsten parts for F4E TDP

- Parts produced according to dimensions required by F4E
- Crack free
- >99.9% density



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[freemelt.com](https://freemelt.com)