

## Experiment Report Form



	<b>Experiment title:</b> Disrupting Additive Manufacturing Microstructures using Thermo-Electric Magnetohydrodynamics	<b>Experiment number:</b> MA 4857
<b>Beamline:</b> ID19	<b>Date of experiment:</b> from: 22/06/2021 to: 26/06/2021	<b>Date of report:</b> 09/09/2021
<b>Shifts:</b> 15	<b>Local contact(s):</b> RACK Alexander, MAJKUT Marta, LUKIC Bratislav	<i>Received at ESRF:</i>
<b>Names and affiliations of applicants</b> (* indicates experimentalists): LEE Peter University College London, Mechanical Engineering CHEN Yunhui University College London, Mechanical Engineering Fan Xianqiang University College London, Mechanical Engineering MARUSSI Sebastian University College London, Mechanical Engineering JAKATA Kudakwashe ESRF REES David University College London, Mechanical Engineering FLEMING Tristan Queens University BROCHE Ludovic ESRF FITZPATRIC Maureen ESRF		

**Report:** We successfully implemented the second generation blown powder manufacturing process replicator (BAMPR-II) on to ID19 beamline. ID19's ultra-fast imaging and ring upgrade's superior phase contrast, coupled with BAMPR have enabled: 1. understanding and quantifying the dynamic fluctuations in fluid flow; 2. capturing pore, crack and other microstructural feature formation during the DED-AM; 3. understanding the influence of TEMHD; and 4. disrupting epitaxial growth to achieve a fine equiaxed microstructure using TEMHD. This is the first time that DED-AM process is recorded at > 40 kHz under X-ray. The results will firstly shed new light in the understanding of the microstructure and defects development during LAM and their impact on the mechanical properties and secondly will provide guidance in the practise of using TEMHD during LAM processes.



**Figure 1. BAMPRII system mounted in ID19 hutch**

# BLOWN POWDER LASER ADDITIVE MANUFACTURING

Laser beam

Melt pool

Figure 2. X-ray radiography results captured at ID19 at > 40 kHz framerate showing porosity formation and melt pool dynamics