AR Lab

Additive Research Laboratory

AMBER

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The AR-Lab will be a pivotal component of AMBER's research focussed on the fundamental material science challenges associated with 3D printing. We have invested in a purpose built suite of 3D printing technology which spans the full spectrum of materials from ceramics and metals to polymers and biomaterials. This investment will play a leading role in the emerging 3D printing national research ecosystem. It will enable AMBER to build on our foundation of research excellence in materials science to become leaders in this emerging technology which is critical to a variety of sectors within Ireland including medical devices, manufacturing technologies and electronic devices.

AMBER is already collaborating with a number of companies in these areas as they seek to exploit these exciting technologies. AMBER's AR-Lab has and will enable new partnerships and collaborations between AMBER and innovation-led SMEs and multinationals. It will also drive new international collaborations in next generation material sets for additive manufacturing with leading universities and research centres.

The AR-Lab has been enabled by a €3.3M award from Science Foundation Ireland as part of their Research Infrastructure program and an additional €1M investment from the European Research Council through our world leading investigators.

Lithoz Cerafab 7500

A ceramic additive manufacturing tool – the first of its type in Ireland, and specifically modified for AMBER to be the highest resolution tool of its type in the world. It is capable of 3D printing a wide range of advanced engineering, and biomedical grade ceramics into highly complex geometries. Historically, technologies available to process ceramics into complex shapes, particularly at small dimension feature sizes, have been limited by material fragility. Applications using this technology include (but are not limited to) bone implants, high temperature/wear/corrosive environments, space and aerospace and communications technologies.

Nanoscribe Photonics Professional GT

A highly specialized stereolithography tool, capable of 3D printing a range of UV curable polymers from sub-millimetre down to nano-scale dimensions. Feature sizes at these lower dimensions will enable research into applications such as photonics and optics, bioengineering, bio-mimetics, micro-fluidics, interfacial surface interactions and metamaterials.

Realizer SLM 50

The highest resolution conventional metal powder bed selective laser melting (SLM) tool available on the market and the first one of its type in Ireland. It is capable of 3D printing the broadest range of conventional SLM powdered metal alloys, some precious metals, but particularly metals for the design of bone implants. This system has been designed using an unusual laser configuration which enables a high degree of flexibility and control of alloy melt processing – exactly what is required for bio-metal materials science research and delivering personal therapies to patients.

3D Systems ProX DMP200

This metal powder bed SLM tool – the first one of its type in Ireland – was originally developed for the processing of dry powdered ceramics. This unusual capability increases the flexibility of the tool for processing very fine and non-regular metal powders (those doped with nanomaterials for example), that may not be 'optimised' for use on other, more conventional, SLM platforms. A knock-on benefit of this is a much wider design-form/shape envelope than many SLM tools, enabling applications in aerospace, energy and bio-engineering where the value proposition involves breaking form-function constraints.

Optomec AerosolJet 300 System

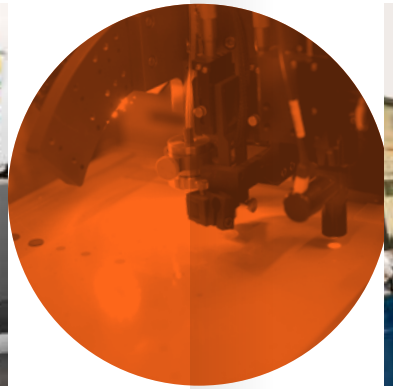
This is a printing platform uniquely specified for spatially depositing AMBER's bespoke liquid exfoliated nano-materials, that form the backbone of research for Professor Jonathan Coleman's European Research Council (ERC) Advanced award into nano-ink printed electronics, and Professor Valeria Nicolosi's ERC Consolidator award into 3D printing of nano-materials for next generation energy storage. This piece of equipment is unique in the field world-wide due to its ability to co-print 2 nano-inks simultaneously in continuously varying proportions ("spatial grading").

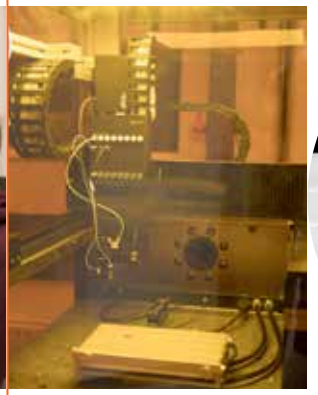
MicroDrop Autodrop Gantry

A bespoke ink-jet platform again matched for use for the deposition of AMBER's bespoke nano-material inks. This tool is complementary to the AerosolJet platform above, for the same research purposes — but it has the additional capability of being a precision micro-fluidic instrument that enables specific performance figures of merit to be accurately correlated to nano-material devices across both platforms.

The Optomec and MicroDrop are part of projects that have received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme under grant agreement numbers 681544 and 694101






Support Platforms:

Nikon XTH225 ST

This is an essential non-destructive characterisation platform for evaluating the shape/structure and materials design properties of AM parts fabricated on the above tool-sets. Sequential X-ray images are used to image completed AM parts through 360 degrees. From this, advanced graphical rendering and processing software can re-image the part in 3-dimensions – down to 1 micron in minimal resolution. Qualitative and semi-qualitative information on defects, geometry, voids/inclusion, microstructure and dimensional stability can be obtained, which will inform the need for further higher resolution materials characterisation, available in AMBER's adjoining Advanced Microscopy Laboratory.

Brabender KETSE 20/40 EC

A powerful and highly accurate polymer twin-screw compounder -extruder. This is a materials-feedstock support platform for our polymer fused filament fabrication AM capability, which will produce bespoke polymer filaments to support centre research into nano -composites, hierarchical co-polymers, bio-engineering and filtration applications.
This will lead to new classes of printable polymers and so enable a broad use of this technology.

A number of other bespoke tools are available in our other laboratories and we are happy to provide more detail on these as requested.

Who is involved?

A number of AMBER's Principal Investigators and technology leads are driving research associated with 3D printing including:

- Prof Mick Morris
- Prof Daniel Kelly
- Prof Garret O'Donnell
- Prof Rocco Lupoi
- Dr Daniel Trimble
- Dr Ramesh Babu
- Prof Valeria Nicolosi
- Prof Jonathan Coleman

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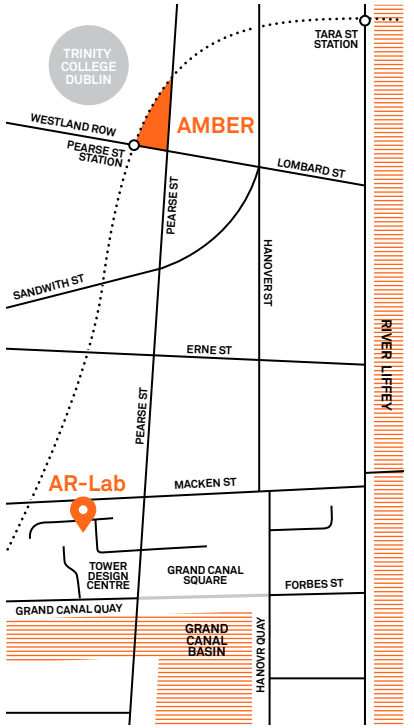

AR Lab

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